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MEMOIRS
OF THE
Royal Society;

Being a New ABRIDGMENT of the

Philosophical Transactions:

Giving an ACCOUNT of the Undertakings, Studies, and Labours of the LEARNED and INGENIOUS in many considerable Parts of the WORLD; from the first Institution of that ILLUSTRIOUS SOCIETY in the Year 1665, to the Year of our LORD 1735 inclusive.

The whole carefully abridg'd from the Originals, and the Order of Time regularly observ'd, with a Translation of the LATIN TRACTS, and the Theoretical Parts apply'd to Practical Uses; also an Explanation of the Terms of ART as they occur in the Course of the Work; being a Work of general Use to the Publick, and worthy the Perusal of all MATHEMATICIANS, ARTIFICERS, TRADESMEN, &c. for their Improvement, in various Branches of Business.

By Mr. BADDAM.

Illustrated with a great Variety of COPPER PLATES.

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M.DCC.XXXIX.

MEMOIRS

OF THE

ROYAL SOCIETY;

Being a New ABRIDGMENT of the

PHILOSOPHICAL TRANSACTIONS.

Of the Cochineel-Fly. Philoſophical Tranſactions N° 193 p. 502.

THE inſect, of which the cochineel is formed, is affirmed to be the very ſame, with what we call the lady-bird, or cow-lady; it appears at firſt like a ſmall bliſter, or little knob upon the leaves of the ſhrub, on which they breed, which afterwards, by the heat of the ſun, becomes a live inſect, or ſmall grub; theſe grubs, in proceſs of time, become flies, and when come to maturity (which muſt be found out by experience, in collecting them at ſeveral ſeaſons) they kill them, by making a great ſmother of ſome combuſtible matter, to the windward of the ſhrubs, on which the inſects are feeding (having firſt ſpread ſome cloths under the plants) whereby all the inſects being ſmothered, and killed, by ſhaking the plants, they will fall down upon the cloths, and thus they are gathered in great quantities with little trouble; then they ſpread them on the ſame cloths in ſome bare ſandy place, or ſtone-pavement, and expoſe them to the heat of the ſun, till they are

dry, and their bodies ſhriveled up, which, rubbed gently betwixt one's hands, will crumble into grains, and the wings will fall from them, which muſt be garbled out: Others, it is ſaid, expoſe them to the ſun in broad and ſhallow copper baſons, wherein the reflection of the ſun will dry them ſooner: The tree, or ſhrub, on which they breed, called the prickly-pear, or *Indian Fig*, is eaſily and quickly propagated, by putting a ſingle leaf, above half its depth, into the ground, which ſeldom fails to take root, and emit other new leaves at the top thereof; others ſay, they may be raiſed from the ſeed or ſmall grains, which are to be found in the proper ſeaſon in the fruit, which is ſomething like a fig, ariſing out of certain yellow flowers, or bloſſoms, that grow out at the tops of the uppermoſt leaves; which fruit is full of a red pulp, that, when fully ripe, ſtains the hands, like mulberries, with a purple or blood colour; on which, or on the bloſſoms, ſome ſay the inſects feed; which poſſibly may be the cauſe of that rich tincture within their bowels.

The Preſſure of Water *in great Depths.* Phil. Tranſ. N° 193. p. 504.

OFF of *Pantalara*, near *Sicily*, a bottle was let down ſeventy fathoms, ſtopped with a very good tender cork, well fitted, and the cork came up in the bottle, which was ¾ full of ſalt-water; the bottle was again fitted with an excellent good cork, but of a woodineſs or hardneſs ſome corks are of, with which being let down in the ſame manner, the cork continued in its place, but bruiſed, as it were; and the bottle, as before, about ¾ full of ſalt water; whereupon, a good ox-bladder was bound four-fold over the mouth of the bottle, without any cork at all, only a piece of leather was put to prevent the glaſs's cutting the bladder; and thus it was let down as before, but taken up without any water, or the leaſt moiſture therein; at the diſtance of ſome leagues from the coaſt of *South Spain*, off the great hills of *Granada*, a leather was tied on the mouth of a bottle, tying over that a ſingle part of the bladder, and the bottle was ſunk 75 fathoms, but it came up again entire; then a hole was made in the leather, about the bigneſs of a large pea, and the bottle was again ſunk 75 fathoms, but it came up perforated in the vacant place, where the leather had the hole in it, and almoſt full of water; then another part of the bladder was bound ſingle over it, and let down but 30 fathoms, but it came up whole and entire; after which it was ſunk 50 fathoms, and it came up broken, and the bottle full of water; then the bottle was fitted again, with the

the ſaid perforated piece of leather, and a double bladder, and let down 50 fathoms, but it came up again entire; but upon ſinking it 75 fathoms, it then came up broken, and the bottle full of water; in 39 ¼ degrees of latitude, and about 150 leagues weſtward of *Portugal*, a *Florence* flaſk was well ſtopped with a bladder over its mouth, and let down 30 fathom, but it was taken up broken.

The Lumbricus Hydropicus; *by Dr.* Edw. Tyſon. Phil. Tranſ. N° 193. p. 506.

IN the diſſection of a gazella or antelope, Dr. *Tyſon* obſerved ſeveral *Hydatides*, or films, filled with limpid water, about the bigneſs of a pigeon's egg, and of an oval form, faſtened to the *Omentum*, and ſome in the *Pelvis*, between the bladder of urine and the *Rectum*; he had obſerved the like watry bags or hydatides in other animals, and he ſuſpected them to be a particular ſort of inſect bred in animal bodies, or at leaſt the embrio's or eggs of them. 1. Becauſe he obſerved them included in an external membrane, like a *Matrix*, ſo looſely, that by opening it with the finger, or a knife, the internal bladder, containing the *Lympha* or *Serum*, ſeemed no where to have any connection with it, but would very readily drop out, ſtill retaining its liquor, without ſpilling any of it. 2. He obſerved, that this internal bladder had a neck, or white body, more opake than the reſt of the bladder, and protuberant from it, with an orifice at its extremity; by this it might, as by a mouth, exhauſt the *Serum* from the external membrane, and ſo ſupply its bladder, or ſtomach. 3. Upon bringing this neck near the candle, it was found really to move, and then ſhorten itſelf. Fig. 1. Plate I. repreſents one of theſe watry bladders incloſed in its external membrane, or *Chorion*; its ſhape was almoſt round, only flatted as a drop of quickſilver will be, by lying on a plane; *a* ſhews the neck, ſeen thro' the membrane, which in Fig. 2. is more plainly repreſented (the external membrane being taken off) but as appearing to the naked eye; where we may obſerve an open orifice at its extremity, and that it conſiſts of circular rings, or inciſures, which in Fig. 3. being viewed by a microſcope, do more evidently diſcover themſelves; this part is granulated with a number of fine eminences all over; the orifice at the extremity ſeems to be formed by retracting itſelf inwards; and upon trial it was found ſo; for in Fig. 4. is repreſented the neck of this worm, drawn out its whole length, and magnified; where may be obſerved the leſſening of the rings,

rings, and its tending to a point at the end; and opening it, there was found within two ſtrings *a a*, proceeding from the neck, and floating in the liquor; whoſe uſe may be to convey into the ſtomach or bladder the moiſture or nouriſhment, which the worm, by protruding its neck attracts from the external membrane; and that this bladder is the ſtomach, will appear leſs unreaſonable, if we conſider how prodigiouſly large the ſtomach is in ſome inſects in proportion to the other parts of the body; in a leech you may obſerve not a ſingle, but above 20 ſtomachs, which empty out of one into another, and run the whole length of the body; and what *Malpighi* obſerves of the ſilk-worm, that it would devour in one day as much as the weight of its whole body, holds more truly of a leech, that will do as much at a meal: Some will poſſibly be more inclined to think, that the whole is but an egg, or embrio of another inſect, and that this bladder is the *Amnion*, and the external coat that includes it in the *Chorion*; but formerly, in diſſecting a rotten ſheep, wherein Dr. *Tyſon* found many of theſe *Hydatides*, and opening ſeveral of them, he obſerved the ſame ſtructure in all; and doubtleſs had they been real embrios, ſome of them would have come nearer to a ſtate of perfection than others; he therefore thinks theſe *Hydatides* to be a ſort of worms or inſects *ſui Generis*; and becauſe they contain ſo much water, and are uſually to be met with in rotten ſheep which are hydropical, Dr. *Tyſon* calls them *Lumbrici Hydropici:* But he does not think that all the bladders to be found in morbid bodies, are of this ſort; for in ſome he did not obſerve this neck and ſtructure of parts, but only a tranſparent bladder, filled with a *Lympha:* Thus, upon opening the right ſide of a patient, a little below her ſhort ribs, there iſſued out a great deal of limpid water, and together with it a great many *Hydatides* to the number of 500; moſt of which were entire and filled with limpid water, the films of others, that were too large for the orifice were broken, but in none of them could he obſerve the neck; which made him think them different from the preſent ſubject, as are likewiſe thoſe he frequently met with in the *Ovaria* or teſticles of women, who have died hydropical, which he only takes to be the eggs, contained therein, ſwelled to that bigneſs by a great flux of humours into them.

The

The visible Conjunctions of the inferior Planets *with the* Sun; *by* Mr. *Halley*. Phil. Tranſ. N° 193. p. 511. *Tranſlated from the* Latin.

THAT *Mercury* and *Venus* do enter the diſk of the ſun and appear thereon like ſo many black ſpots, is evident, both from the principles of ſound aſtronomy, and undoubted obſervations; but by what laws, or conditions, or in what period of years theſe phænomena offer themſelves to our view, has not been determined by any of our modern aſtronomers; on which account Mr. *Halley* thought it would not be unacceptable, if he ſeriouſly applied himſelf to this diſquiſition, and cleared up a ſubject ſo perplexed and ſo little underſtood.

It is ſelf-evident that theſe phaſes of theſe planets always happen in their conjunctions with the ſun, when retrograde; *viz.* when the ſun is ſo near their nodes, that the latitude of the planet, in its conjunction with the ſun, does not exceed the ſemidiameter of the latter; that the limits and conditions of theſe conjunctions may be the more eaſily inveſtigated, and ſince the elements of the calculation are entirely different, each planet is to be treated of apart: And therefore to begin with *Mercury*; it is certain that according to late and accurate obſervations, the aſcending node of this planet, in this century, *viz. March* 1691, is found near the 15° of *Taurus*, or rather at 0 S. 15° 44′ from the firſt ſtar of *Aries*; and the oppoſite deſcending at 6 S. 15° 44′ from the ſame ſtar; the inclination of the plane of *Mercury*'s orbit to the ecliptic according to *Kepler* is 6° 54′ which is nearly exact: Now it appears from the moſt approved hypotheſes, that the diſtance of *Mercury* from the ſun, when in the aſcending node, is 31365 parts, of which the mean diſtance of the ſun from the earth is 100000; but when it is in the other node, that diſtance, meaſured in the ſame parts, is 45308: The ſun, when oppoſite to the aſcending node, is diſtant from the earth, in conjunction therewith, 98955 parts, but in the other node, the ſame diſtance becomes 101007; and therefore *Mercury*, in conjunction with the ſun at the aſcending node, is diſtant from the earth 67591 parts, but at the deſcending node 55699; which widely differing from each other, theſe conjunctions, that happen in different nodes, are alſo to be conſidered ſeparately.

Let *Mercury*, when retrograde, be in a central conjunction with the ſun in the aſcending node, in the month of *October*; and from the above hypotheſes we ſhall have as follows;

The

	S	°	′	″
The longitude of the ſun from the firſt ſtar of *Aries* — — — — —	6	15	44	00
The longitude of *Mercury* ſeen from the ſun	0	15	44	00
The diſtance of *Mercury* from the ſun 31365				
——————— from the earth 67591				
The angle of the inclination of *Mercury*'s orbit	0	6	54	00
The motion of *Mercury*, ſeen from the ſun, in 6 hours — — — —	0	1	30	58
——— of the ſun in the ſame 6 hours	0	0	15	5
Hence the motion of *Mercury* from the ſun in 6 hours — — — — —	0	5	15	53
And his motion from the ſun ſeen from the earth in 6 hours — — —	0	0	35	12
And the angle of the viſible way of *Mercury* within the ſun with the ecliptic —	0	8	15	00
Hence the motion of *Mercury* in his viſible orbit in 6 hours — — —	0	0	35	40
Then the motion of *Mercury* in a ſidereal year four revolutions beſides is, — — —	1	24	45	8
Therefore in 13 years — — —	11	21	46	44
There are therefore wanting to 54 intire revolutions — — — —	0	8	13	16

	d.	h.	m.
Which ſpace *Mercury* runs over in — —	2	00	11

	°	′	″
By which the ſun's place is advanced, and *Mercury*, poſited in the node, is as much diſtant from the conjunction of the earth — — —	2	1	00
But that arch ſeen from the earth becomes —	0	56	10
Whence from the given angle of the viſible way 8° 15′ ariſes the baſe or diſtance from the viſible conjunction — — — — —	0	55	34

	h.	m.
Which arch is run over by *Mercury* in — —	9	21
But 13 ſidereal years exceed ſo many *Julian* ones with 3 intercalations by — — — —	8	0

	d.	h.	m.
Therefore *Mercury* returns to the ſun after 13 *Julian* years, and beſides — — —	2	17	34
Or, with four intercalations, if the preceeding year be the third after *Biſſextile* — —	1	17	34

But

But from the arch 56′ 10″ and given angle, the perpendicular or neareſt diſtance of *Mercury* from the ſun becomes — — — — —	° 0	′ 8	″ 3

Therefore *Mercury* ſeen within the ſun after 13 years advances more northerly by 8′ 3″

	S	°	′	″
By the like reaſoning in 46 ſidereal years *Mercury* moves — — —	11	28	36	8
There are therefore wanting to 191 intire revolutions — — — —	0	1	23	52

	h.	m.
That is in time — — — —	8	12

	°	′	″
By which the ſun is advanced — — —	0	20	41
This arch ſeen from the earth becomes — —	0	9	36
The baſe anſwering thereto — — —	0	9	30

	h.	m.
The time, in which *Mercury* runs over the baſe, is	1	30
But 46 ſidereal years exceed as many *Julian* with 11 intercalations by — — — —	19	3

	d.	h.	m.
And *Mercury* returns to the ſun after 46 *Julian* years and beſides — — — —	1	4	51
Or, with 12 intercalations, that it becomes, when the preceeding year is either the ſecond or third after *Biſſextile* — — — —	0	4	51

	°	′	″
But the perpendicular, by which *Mercury* advances to the north, becomes — — —	0	1	22

	h.	m.	ſ.
The moſt accurate period of *Mercury* to the ſun is abſolved in 263 ſidereal years and beſides	1	11	30
And theſe ſidereal years exceed as many *Julian* with 66 intercalations by — —	10	20	0

	d.	h.	m.	ſ.
Whence after 263 *Julian* years *Mercury* revolves to the ſun, but later by —	0	11	33	30
But if the preceeding year be *Biſſextile*, add	1	11	31	30
At length after this interval it advances more northerly by — — — —	0	0	0	10

The other wider periods are eaſily diſcovered from what has been juſt now found, and they are either of 6 or 7 years; that of 7 years

7 years depreſſes *Mercury* 22′ 47″ to the ſouth; and 7 whole days, leſs by 9′, ſooner, if there have been two intercalations; but with one intercalation, *viz.* when the former year is biſſextile, 6 days are to be ſubducted, adding only 9′ as before: It is more rarely that after 6 years this planet is ſeen again in the ſun's diſk; after that period it paſſes 30′ 50″ more northerly; and that later by 9 d. 17 h. 25 m. if the preceeding year be the ſecond or third after biſſextile; otherwiſe 8 d. 17 h. 25 m. are to be added.

Likewiſe if the conjunction happen at the deſcending node in *April*.

	S	°	′	″
The longitude of the ſun from the firſt ſtar of *Aries* — — — — —	0	15	44	00
The longitude of *Mercury* ſeen from the ſun	6	15	44	00
The diſtance of the planet from the ſun	45308			
Its diſtance from the earth — —	55699			
The motion of *Mercury* ſeen from the ſun in ſix hours — — — —	0	0	14	29
The motion of the ſun in the ſame time —	0	0	43	21
——— of *Mercury* from the ſun —	0	0	28	52
Hence the angle of the viſible way of *Mercury* within the diſk of the ſun with the ecliptic is — — — —	0	10	18	00
And the viſible motion from the earth in 6 hours	0	0	23	52

Whence by following the method of the preceeding calculus, it is evinced that *Mercury*, after 13 years and beſides 3 d. 7 h. 37 m. revolves to its conjunction with the ſun; but if the preceeding year be the third after biſſextile, in that caſe 2 d. 7 h. 37 m. are only to be added; and then *Mercury* will be found to advance 16′ 55″ more ſoutherly: After 46 years with 12 intercalations add 7 h. 14 m. and *Mercury* will be in conjunction with the ſun 2′ 23″ more ſoutherly; but if the former be biſſextile, or the firſt after it, 1 d. 7 h. 14 m. are to be added, in order to have the conjunction accurately: In like manner, after 263 years, in which *Mercury* declines 0′ 22″ to the ſouth, either 1 d. 11 h. 49 m. or 11 h. 49 m. are to be added according to the rule preſcribed in the former caſe: But in 6 or 7 years, becauſe of the nearneſs of the earth and that planet, and therefore on account of the enlarged arches at this node, it does not return to the ſun, ſo as to be ſeen within its diſk: After 33 years it paſſes over the ſun 14′ 2″ more northerly, and the moment of the conjunction is had by ſubſtracting,

ing, from the time of the former, 3 d. 0 h. 23 m. if it be the third year after biſſextile; otherwiſe ſubſtract 2 d. 0 h. 23 m. only: Having found theſe, it will be an eaſy matter to continue the calculus for all the conjunctions of *Mercury* with the ſun, and that with the greateſt certainty; by addition only, the moments of conjunctions and the diſtances of the planet from the centre of the ſun are obtained; whence likewiſe by the help of the table, the durations of theſe eclipſes, are diſcovered, ſo that nothing ſeems to be wanting in this affair: As to the *Epochæ*, theſe are with more ſafety had from the induſtry of obſervers than by the ſubtileſt calculations; therefore Mr. *Halley* choſe for the firſt caſe, that remarkable tranſit of *Mercury* which he himſelf had fully obſerved at St. *Helena*, *October* 28, 1677 O. S. and whoſe middle he determined there at 0 h. 4 m. *p. m.* but at *London* 0 h. 28 m. *p. m.* The way in which the planet ſeemed to advance was 4′ 40″ more northerly than the ſun's centre: In the other caſe, *viz.* when *Mercury* was in conjunction with the ſun *April* 23, 1662 O. S. he appeared at his leaſt diſtance from the ſun's centre at *Dantzic* 6 h. 8 m. *p. m.* and at *London* 4 h. 52 m. being then in the middle of his tranſit, and at the ſame time was diſtant from the ſame centre 4′ 27″ to the north; hence according to the above rules, it was an eaſy matter to exhibit in order all the viſible conjunctions of *Mercury* with the ſun.

A ſeries of the times wherein *Mercury*, being in conjunction with the ſun, is ſeen within his diſk, calculated for the preſent and enſuing century, with the diſtances of the planet from the ſun's centre.

In the month of APRIL

Years	Times of Conjunct.				Diſt. from the Sun's Centre		
	d.	h.	m.		′	″	
1615	22	21	38	*	7	20	N.
1628	25	5	15	*	9	35	S.
1661	23	4	52	*	4	27	N.
1674	26	12	29		12	28	S.
1707	24	12	6		1	34	N.
1720	26	19	43	*	15	21	S.
1740	21	11	43		15	36	N.
1753	24	19	20	*	1	19	S.
1786	22	18	57	*	12	43	N.
1799	26	2	34	*	4	12	S.

In the month of OCTOBER.

Years	Times of Conjunct.				Dist. from the Sun's Centre		
	d.	h.	m.		′	″	
1605	22	8	29		12	48	S.
1618	25	2	4	*	4	45	S.
1631	27	19	37	*	3	18	N.
1644	30	13	11		11	21	N.
1651	23	13	20		11	26	S.
1664	25	6	54	*	3	23	S.
1677	28	0	28	* *	4	40	N.
1690	30	18	2	*	12	43	N.
1697	23	18	11	*	10	4	S.
1710	26	11	45		2	1	S.
1723	29	5	19	*	6	2	N.
1730	22	5	28		16	45	S.
1736	30	22	53	* *	13	5	N.
1743	24	23	2	* *	8	42	S.
1756	26	16	36		0	39	S.
1769	29	10	10		7	24	N.
1776	22	10	19		15	23	S.
	Nov.						
1782	1	3	44	*	15	27	N.
	Oct.						
1789	25	3	53	*	7	20	S.

The tranſits marked with the ſign * are partly viſible at *London*, but thoſe with the ſign * * are entirely to be ſeen there.

Note, that the ſun's diameter at the aſcending node of *Mercury* in the month of *October* is 32′ 34″ 5 and therefore that the greateſt duration of the central tranſit is 5 h. 29 m. but in *April* the ſun's diameter becomes 31′ 54″ whence on account of the ſlower motion of the planet, the greateſt duration is 8 h. 1 m. But if *Mercury* ſhould fall obliquely upon the diſk, theſe durations become ſhorter in proportion to the diſtance from the ſun's centre; and that the calculus might be the more perfect, the following tables are ſubjoined, wherein are exhibited the half durations of theſe eclipſes for each minute of diſtance ſeen from the ſun's centre, which added to, and ſubſtracted from, the moment of conjunction found in the former table, exhibit the beginning and end of the whole phænomenon.

OCTOBER.

Minut. Dist.	Semi-durat. h.	m.
′		
0	2	44
1	2	44
2	2	43
3	2	41½
4	2	39½
5	2	36½
6	2	33½
7	2	28½
8	2	23
9	2	17
10	2	10
11	2	1
12	1	51
13	1	39
14	1	24
15	1	4
15½	0	50
16	0	30

APRIL.

Minut. Dist.	Semi-durat. h.	m.
1		
0	4	0½
1	4	0
2	3	58½
3	3	56
4	3	53
5	3	48½
6	3	43
7	3	36
8	3	28
9	3	18½
10	3	7
11	2	44
12	2	38
13	2	19
14	1	55
15	1	21½
15½	0	56

These numbers do fitly represent all the observations hitherto made, nor need we doubt of the future; seeing of all the planets *Mercury* is the nearest to the sun, so that it cannot in the least be intercepted by the intervention of the centres of the other planets, nor sensibly disturbed by those deviations, which arise from their systems, and to which the superior planets, particularly *Saturn*, are obnoxious: Mr. *Halley* designedly omitted the parallaxes as very inconsiderable, and which being different, in different places, could not be applied in a more general calculation, and because their quantity hath not hitherto been determined; but from such observations they may rather be more certainly derived; he had also as little a regard to *Mercury*'s diameter, because, being extremely small, he seems to adhere for a very few minutes to the limb; for by an accurate observation, *October* 28, 1677, he found, that scarcely two minutes were elapsed, when he entirely quitted the sun; whence he concluded its diameter to be 0′ 11″, and according to the ratio of the distances from the earth at the other node, 0′ 13″ ½ nearly; therefore 3 ½ minutes are spent, while the whole planet directly pervades the sun's limb; but passing obliquely, he continues thereon a little longer, in the ratio of the in-

increaſe of the ſecants of the angles of incidence: There is alſo as little occaſion to eſtimate the equations of time, becauſe for many days in each month they continue conſtant, and, as it were, invariable.

Of the viſible conjunction of *Venus* with the ſun: This ſight, which is by far the nobleſt that aſtronomy affords, like the ſecular games, is denied mortals for a whole century by the ſtrict laws of motion; it will be afterwards ſhewn, that by this obſervation alone, the diſtance of the ſun, from the earth, might be determined with the greateſt certainty, which, on account of the parallax otherwiſe entirely inſenſible, hath not hitherto been preciſely defined: As to the periods, they cannot be ſo accurately determined as thoſe of *Mercury*, ſeeing *Venus* has only once, ſince the creation, been obſerved within the ſun's diſk, and that by our countryman *Horrox*: After having corrected the motions, as much as the ruder obſervations of the ancients would permit, the ſum of the calculation is as follows,

	S	°	′	″
The longitude of the aſcending node of *Venus*, from the firſt ſtar of *Aries* — — —	1	15	16	00
Therefore the ſun is in conjunction with her in the oppoſite point, that is, in theſe centuries, about the end of *November* — — —	7	15	16	00
The diſtance of *Venus* from the ſun 71997 parts.				
—————— the earth 26438.				
The inclination of *Venus*'s orbit to the ecliptic	0	3	23	0
The motion of *Venus* in eight ſidereal years, over 13 revolutions — — — — — —	0	1	30	28½
The motion of *Venus* in 235 ſidereal years, over 38 revolutions — — — — — —	11	29	17	39
The motion of *Venus* in 243 ſidereal years, over 395 revolutions — — — — —	0	00	48	8

From theſe elements making a *Calculus* according to the method explained in *Mercury*, the intervals of the times and diſtances ariſe as follows: After 8 years *Venus* revolves to the ſun; *viz.* after ſubſtracting from the moment of the former tranſit 2 d. 10 h. 52 ½ m. and the planet proceeds in a path 24′ 41″ more ſoutherly than the preceeding: After 235 years, having added 2 d. 10 h. 9 m. *Venus* may again enter the ſun, but 11′ 33″ more northerly; but if the preceeding year be biſſextile, 3 d. 10 h. 9 m. are to be added: After 243 years, *Venus* may likewiſe paſs over the ſun, ſubſtracting only 0 h. 43 m. from the time of the former; but it advances 13′ 8″ more ſoutherly; but if the

the preceeding year be biſſextile, add 23 h. 17 m. And in all theſe appulſes of *Venus* to the ſun in the month of *November*, the angle of the viſible way of *Venus* with the ecliptic is 9° 5′, and her horary motion within the ſun 4′ 7″; and ſince the ſemidiameter of the ſun is 16′ 21″, the greateſt duration of the tranſit of the centre of *Venus* is 7 h. 56 m. Again, let the ſun and *Venus* be in conjunction at the deſcending node in the month of *May*; and according to the ſame numbers the ſame intervals are computed: After 8 years, 2 d. 6 h. 55 m. are to be ſubſtracted, and *Venus* will paſs 19′ 58″ more northerly: After 235 years add 2 d. 8 h. 18 m. or if the former year have been biſſextile 3 d. 8 h. 18 m. and you ſhall have *Venus* paſs 9′ 21″ more ſouthерly: Laſtly, after 243 years add 0 d. 1 h. 23 m. or if the former year have been biſſextile, 1 d. 1 h. 23 m. and *Venus* is again found in conjunction with the ſun, but in a path 10′ 37″ more northerly: In all the tranſits at this node, the angle of the viſible way of *Venus* with the ecliptic is 8° 28′; and her horary motion 4′ 00″, and the ſemidiameter of the ſun ſubtending 15′ 51″, the greateſt duration of the tranſit of the centre is 7 h. 56 m. preciſely the ſame as at the other node: As to the *Epochæ*, it is concluded from the ingreſs of *Venus* into the ſetting ſun, and which was only obſerved by *Horrox*, that *Venus* was in conjunction with the ſun at *London* 1639, *November*, 24 d. 6 h. 37 m. but that ſhe advanced 8′ 30″ towards the ſouth: But in the month of *May*, *Venus* has not hitherto been ſeen by any mortal within the ſun; but from Mr. *Halley*'s calculations it appears, that *Venus* for the next time will enter the ſun 1761, *May*, 25 d. 17 h. 55 m. *viz.* in the middle of an eclipſe, and then be diſtant from his centre towards the ſouth 4′ 15″: Hence, and from the premiſed revolutions, all the phænomena of this kind are eaſily computed for a thouſand years, as appears from the following table;

NOVEMBER.

Year	Time of Conjunct.			Diſt. from the Sun's Centre		
	d.	h.	m.	′	″	
918	20	21	53	6	12	N.
1161	20	21	10	6	55	S.
1396	27	7	20	4	38	N.
1631	26	17	29	16	11	N.
1639	24	6	37	8	30	S.
1874	26	16	46	3	3	N.
2109	29	2	56	14	36	N.
2117	26	16	3	10	5	S.

MAY.

MAY.

Year	Time of Conjunct. d.	h.	m.	Dist. from the Sun's Centre ′	″	
1048	24	13	45	3	50	N.
1283	23	8	14	5	31	S.
1291	25	15	9	14	27	N.
1518	25	16	32	14	52	S.
1526	23	9	37	5	6	N.
1761	25	17	55	4	15	S.
1769	23	11	00	15	43	N.
1996	28	2	13	13	36	S.
2004	25	19	18	6	22	N.

As to the duration of these eclipses of *Venus*, they may, with respect to the centre, be calculated in the same manner as those of *Mercury* were; but seeing the diameter of *Venus* is pretty large, and the parallaxes may cause a considerable difference as to the time, there must necessarily be a peculiar calculation for each place: The diameter of *Venus* is so great, that whilst she adheres to the limb of the sun, almost 20 minutes of time are spent, *viz.* when she directly enters the sun; but falling obliquely into him, she makes a longer stay on his limb: Her diameter, according to the observation of *Horrox*, is 1′ 18″, when she is in conjunction with the sun at the ascending node; and 1′ 12″ at the descending node.

The principal use of these conjunctions is, accurately to determine the distance of the sun from the earth or his parallax, which astronomers have by several methods attempted in vain, whilst the smallness of the angles sought do easily elude the nicest instruments; but in observing the ingress of *Venus* into, and egress from, the sun, the space of time between the moments of the internal contacts may be obtained to a second of time, that is, to $\frac{1}{15}$ of a second, or 4‴ of the observed arch, by means of an ordinary telescope and clock that goes accurately for six or eight hours.

The Production of Tadpoles; *by Mr.* Rich. Waller. Phil. Trans. N° 193. p. 523.

MR. *Waller* took some frog-spawn out of a ditch, which, he supposed, might have been spawned about 14 days, and kept it in a galley-pot of water, which he shifted every day or two, and kept them in a window where the sun shined some part of the day; at first they appeared as in Fig. 5. Plate I. being a round

Fig. I.

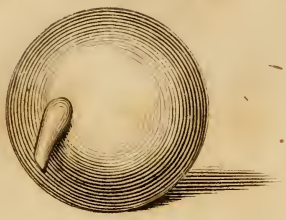


Fig. II.

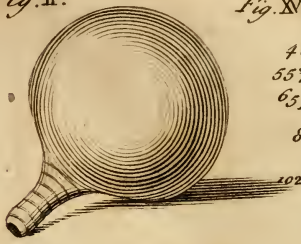


Fig. XVII.

45
48 — 51 3/7
55 5/13 — 60
65 5/11 — 72
80
90
102 6/7
120
144
180
240
360
720

Fig. III.

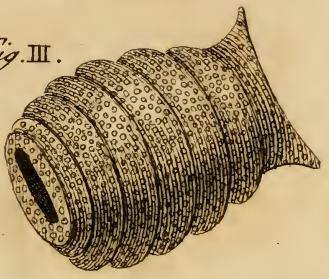


Fig. V.

Fig. VI.

Fig. VII.

Fig. VIII.

Fig. IV.

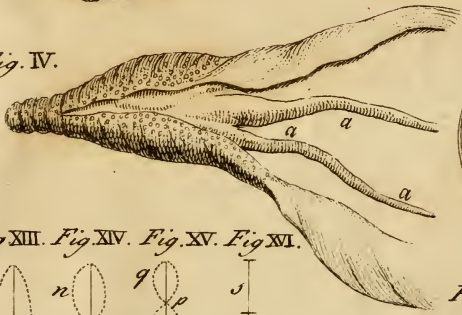


Fig. IX.

Fig. XIII. Fig. XIV. Fig. XV. Fig. XVI.

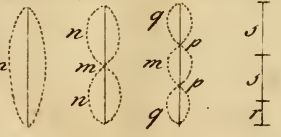
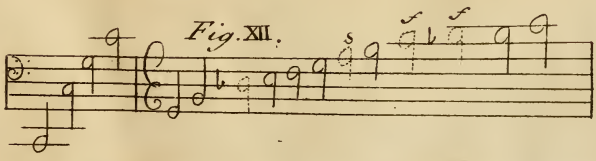


Fig. X.

Fig. XI.

Fig. XII.



round black globule, encompaſſed with a clear liquor, which was included in a membrane, and that again was ſurrounded with a larger ſphere of a more mucous liquor; the ſecond and third days they appeared as in Fig. 6. the fourth day as in Fig. 7. about the ſixth day, ſeveral of them were looſened from their eggs, and on the ſeventh and eight more of them; when they appeared of the ſhape of Fig. 8. which in Fig. 9. is repreſented larger than the life; on the ſeventh and eighth days, upon pricking them with the point of a needle, they would contract themſelves; ſome of them, would on the eighth day, of themſelves, bend their bodies, but not move out of their place: When they firſt got thro' their egg, which probably they did by eating their way, they hung faſt upon its outſide, by that part which was afterwards found to be their mouth, and when looſened from their hold, they would ſink to the bottom of the water, without being able to riſe again; on the ninth, they were not ſenſibly increaſed in bulk, only they moved more freely at the bottom of the veſſel: In about 14 days, they appeared as in Fig. 10. at which time they ſwam about in the water by moving their tails as Fig. 11. and ſome rudiments of their fore-legs were viſible, which looked forked, and like the ſprig of a plant; at the end of three weeks their mouths were to be ſeen, which they opened and ſhut, and emitted fœces from the other end; in a month the eyes were to be diſcerned, at which time they would ſwim near the top of the water, and opening their mouths emit a ſmall bubble of air, and poſſibly take in freſh air: The liquor, contained in the innermoſt membrane, was more tranſparent than the other, which was a mucous liquor, and like the white of an egg; the whole was a little heavier in ſpecie than water; for a ſingle egg ſunk, when looſened from the reſt; but when they were faſtened together, they would float, every three eggs leaving a little ſpace, which, being filled with air, made them ſpecifically lighter than common water.

A ruminating Man; *by Dr.* Fred. Slare. Phil. Tranſ. N° 193. p. 525.

THIS ruminating man lived at *Briſtol*; he would begin to chew his meat over-again within a quarter of an hour after his meals, if he drank upon them; if not, it was ſome time longer; this chewing, after a full meal, laſted about an hour and a half; if he went to bed preſently after meals, he could not ſleep, till the uſual time of chewing was over; the victuals, upon their return, taſted ſomewhat more pleaſant than at firſt; bread, meat, cheeſe, and drink ſeemed to return much of

the ſame colour, they would be of, were they mixed together in a mortar; liquids, as broth and ſpoon-meat, returned to his mouth all one as dry and ſolid food; the victuals ſeemed to the patient to lie heavy in the lower part of his throat, until they had undergone the ſecond chewing; afterwards they would paſs clean away; and he always obſerved, that if he eat variety of things, what he ſwallowed firſt, would again come up firſt to be chewed; if this faculty intermitted at any time, it portended ſickneſs, and he was never well, till it returned again; the patient was always thus affected, ſince he could remember; his father ſometimes chewed his cud, but in ſmall quantities, and nothing like his ſon.

The Weſt-India *Way of dreſſing* Buck *and* Doe-Skins; *by Sir* Rob. Southwel. Phil. Tranſ. N° 194. p. 532.

AFTER the pelt is taken off, it is firſt ſtretched out by lines on a ſort of rack for drying them, and the brains of the deer are taken out, and laid on moſs, or dried graſs, and then dried in the ſun, or at a fire, to preſerve them: When the hunting time is over, the women dreſs the ſkins; firſt, by putting them in a pond, or hole of water, to ſoak them well; then with an old knife, fixed in a cleft ſtick, they ſcrape off the hair, whilſt they are wet; the ſkins being thus prepared, they put them, and a certain proportion of the dried brains into a kettle over a fire, till they are more than blood-warm, which will make them lather and ſcour perfectly clean; after which, they wring and twiſt each ſkin with ſmall ſticks, as long as they find any water drop from them, and they continue in this twiſted condition for ſome hours; and then they untwiſt each ſkin, and put them into a ſort of rack, like a clothier's rack, conſiſting of two poles ſet upright, and two more ſet athwart, and fixed with their own barks; then they ſtretch them out every way by lines; and as the ſkin dries, with a dull hatchet, or a ſtick flatted and brought to a round edge, or a ſtone, they rub them all over, to force out the water and greaſe out of them, till they become perfectly dry; and this is the whole proceſs; and one woman will dreſs eight or ten ſkins in a day.

Of the Thickneſs of Gold *on* Gilt-Wire, *and of the exceeding Minuteneſs of its conſiſtent* Particles; *by Mr.* Edm. Halley. Phil. Tranſ. N° 194. p. 540.

WHAT are the conſtituent parts of matter, and how there happens to be ſo great a variety in the weight of bodies, which, to all appearance, are equally ſolid and denſe, ſuch as gold

gold and glaſs, whoſe ſpecific gravities are nearly as 7 to 1, ſeems a very hard queſtion to thoſe that rightly conſider it; for from undoubted experiment, gravity is in all bodies proportional to the quantity of matter in each, and there is no ſuch thing, as a propenſion of ſome more, others leſs, towards the centre of the earth, ſince, the reſiſtance of the air being removed, all bodies deſcend, be they never ſo looſe or compact in texture, with equal velocity; it follows therefore, that there is ſeven times as much matter in gold, as in a piece of glaſs of the ſame magnitude; and conſequently, that at leaſt, ſix parts of ſeven in the bulk of glaſs muſt be pore or vacuity: This ſome favourers of the atomical philoſophy have endeavoured to ſolve, by ſuppoſing the primary or conſtituent atoms of gold to be much larger than thoſe of other bodies, and conſequently the pores fewer; whereas in other bodies, the great number of the interſperſed vacuities does diminiſh their weight: Mr. *Halley* being deſirous to examine this notion of the magnitude of the atoms of gold, he bethought himſelf of the extreme ductility of that metal, which is ſeen in the beating of it to leaf; and above all, in the drawing fine gilt wire; by means whereof, he was of opinion, he might moſt exactly obtain the true thickneſs of the coat of gold, that appears even by the microſcope, ſo well to repreſent gold itſelf, that not the leaſt point of ſilver is ſeen thro' it: In order to this, he informed himſelf of the wire-drawers, what gold they uſed to their ſilver; and he was told, that the very beſt double-gilt wire was made out of cylindrical ingots, 4 inches in circumference, and 28 inches long, which weigh 16 pounds *Troy*; on theſe they beſtow 4 ounces of gold, that is, to every 48 ounces of ſilver, one of gold; and that two yards of the ſuperfine wire weighs a grain: Hence, at firſt ſight it appeared, that the length of 98 yards is in weight 49 grains; and that a ſingle grain of gold covers the ſaid 98 yards; and that the 1000000th part of a grain of gold is viſible without a microſcope: But Mr. *Halley* being deſirous to compute the thickneſs of the ſkin of gold, by means of the ſpecific gravities of the metals, *viz.* ſilver 10 $\frac{1}{3}$, and gold 18 $\frac{2}{3}$, he found the diameter of ſuch wire the $\frac{1}{386}$ part of an inch, and its circumference the $1\frac{1}{2}$ part, but the gold in thickneſs not to exceed the $\frac{1}{1300}$ part of an inch; whence it may be concluded, that the cube of the hundredth part of an inch would contain above 2433000000 (or the cube of 1345) of ſuch atoms; and which is ſurpriſing, tho' gold be ſtretched out to ſo great a degree, yet it ſhews itſelf of ſo even and uniform a texture, as not to ſuffer the white colour of the ſilver to appear thro' it, which argues that even in this

exceeding thinneſs, many of thoſe atoms may ſtill lie one over the other.

Of the ſeveral Species *of infinite* Quantities, *and their* Ratio's *to each other*; *by Mr.* Edm. Halley. Phil. Tranſ. N° 195. p. 556.

THAT all magnitudes infinitely great, or ſuch as exceed any aſſignable quantity, are equal amongſt themſelves, tho' it be vulgarly received as a maxim, is not yet ſo common, as it is erroneous; and the reaſon of the miſtake ſeems to be, that the mind of man coming to contemplate the extenſions of what exceeds the bounds of its capacity, and of which the very idea does include a negation of limits, it comes to paſs that we acquieſce generally, and it ſuffices to ſay, ſuch a quantity is infinite: But if we examine this notion more narrowly, we ſhall find, that there are really beſides infinite length, and infinite area, no leſs than three ſeveral ſorts of infinite ſolidity; all which are quantities *ſui generis*, having no more relation to each other, than a line hath to a plane, or a plane to a ſolid, or a finite to an infinite; but that amongſt themſelves, each of thoſe ſpecies of infinites are in given ratio's will plainly appear: And firſt, infinite length, or a line infinitely long, is to be conſidered, either as beginning at a point, and ſo infinitely extended one way, or elſe both ways from the ſame point; in which caſe, the one, which is a beginning infinity, is the half of the whole, which is the aggregate of the beginning and ceaſing infinity; or, as we may ſay, of infinity *a parte ante* and *a parte poſt*; which is analogous to eternity, in which there is always as much to follow as is already paſt, from any point or moment of duration; nor doth the addition or ſubſtraction of finite length, or ſpace of time, alter the caſe either in infinity or eternity, ſince neither the one nor the other can be any part of the whole: As to infinite ſurface or area, any righe line, infinitely extended both ways on an infinite plane, does divide that infinite plane into equal parts, the one to the right, and the other to the left of the ſaid line; but if from any point in ſuch a plane, two right lines be infinitely extended, ſo as to make an angle, the infinite area, intercepted between thoſe infinite right lines, is to the whole infinite plane, as the arch of a circle, on the point of concourſe of thoſe lines, as a centre, intercepted between the ſaid lines, is to the circumference of the circle; or as the degrees of the angle to 360°; for inſtance, two right lines, meeting at a right angle, do include, on an infinite plane, a quarter of the whole infinite area of ſuch a plane: But if

two

two parallel infinite lines be ſuppoſed drawn on ſuch an infinite plane, the area, intercepted between them, will be likewiſe infinite, but at the ſame time infinitely leſs than that ſpace intercepted between two infinite lines, inclined at never ſo ſmall an angle; becauſe in the one caſe, the given finite diſtance of the parallel lines diminiſhes the infinity in one degree of dimenſion; whereas, in a ſector, there is infinity in both dimenſions; and conſequently, the quantities are the one infinitely greater than the other, and there is ratio between them: From the ſame conſideration ariſe the three ſeveral ſpecies of infinite ſpace or ſolidity, as hath been ſaid; for a parallelopiped, or a cylinder, infinitely long, is greater than any finite magnitude, how great ſoever; and all ſuch ſolids, ſuppoſed to be formed on given baſes, are to each other as thoſe baſes; but if two of theſe three dimenſions be wanting, as in the ſpace intercepted between two parallel planes infinitely extended, and at a finite diſtance; or with infinite length and breadth, with a finite thickneſs; all ſuch ſolids will be to each other as the given finite dimenſions; but theſe quantities, tho' infinitely greater than the other, are yet infinitely leſs than any of thoſe, wherein all the three dimenſions are infinite; ſuch are the ſpaces intercepted between two inclined planes infinitely extended; the ſpace intercepted by the ſurface of a cone, or the ſides of a pyramid, likewiſe infinitely continued, *&c.* of all which notwithſtanding, the ratio's to each other, and to the *το παν* or vaſt abyſs of infinite ſpace (wherein is the *Locus* of all things that are, or can be; or to the ſolid of infinite length, breadth and thickneſs taken all manner of ways) are eaſily aſſignable; for the ſpace between two planes is to the whole, as the angle of thoſe planes to the 360 degrees of the circle: As for cones and pyramids, they are as the ſpherical ſurface, intercepted by them, is to the ſurface of the ſphere, and therefore cones are as the verſed ſines of half their angles to the diameter of the circle: Theſe three ſpecies of infinite quantities are analogous to a line, ſurface, and ſolid, and after the ſame manner cannot be compared, nor have any ratio the one to the other: Beſides theſe, there are ſeveral other ſpecies of infinite quantities, ariſing from the contemplation of curves and their aſymptotes.

The Defects of the Trumpet *and* Trumpet-Marine; *by Mr.* Fran. Roberts. Phil. Tranſ. N° 195. p. 559.

THE extent of the trumpet cannot be ſtrictly determined, it reaches as high as the ſtrength of the breath can force it; but by conſidering its notes within the ordinary compaſs of the ſcale

ſcale of muſick (from double *C-ſa-ut* to *C-ſol-fa*, in *alt*) the nature of the higher notes will plainly appear; Fig. 12. Plate I. and theſe are all ſet down in the table; only obſerve, that the pricked notes are imperfect, not exactly in tune, but a little flatter or ſharper than the places where they ſtand, according as *f* or *ſ* is ſet over them.

Here we may make two inquiries. 1. Whence it is, that the trumpet will perform no other notes (in that compaſs) but only thoſe in the table, which are uſually called by muſicians trumpet-notes, 2. What is the reaſon that the 7th, 11th, 13th and 14th notes are out of tune, and the others exactly in tune.

In this matter we may receive ſome light from the trumpet-marine, an inſtrument, tho' as unlike as poſſible to the trumpet in its frame, one being a wind inſtrument, the other a monochord; yet it hath a wonderful agreement with it in its effect; the ſound is ſo like, as not to be eaſily diſtinguiſhed by the niceſt ear, and, as it performs the very ſame notes, ſo it hath the ſame defects as a trumpet; for if the ſtrings be ſtopped in any part but ſuch as produces a trumpet-note, it yields a harſh and uncouth (not a muſical) ſound.

Let us therefore proceed to our firſt enquiry, and examine what is the reaſon that the trumpet marine will perform no other but the trumpet-notes: It is a known experiment of two uniſon ſtrings, that upon ſtriking one of them, the other moves; which probably proceeds from hence, that the impulſes of the air, which are made by one ſtring, do more eaſily ſet another in motion, which lies in a diſpoſition of having its vibrations ſynchronical to them, than a third, whoſe motion would be croſs: We may improve this a little farther, by obſerving that a ſtring will move not only at the ſtriking of an uniſon, but an 8th or 12th, tho' after a different manner: If an uniſon be ſtruck, it makes one entire vibration in the whole ſtring, and the motion is moſt ſenſibly in the middle *m* Fig. 13. for there the vibrations take the greateſt ſcope; if an 8th be ſtruck, it makes two vibrations; and the point *m* Fig. 14. is in a manner quieſcent, and the moſt ſenſible motion is at *n*, *n*; if a 12th be ſtruck, then it makes three vibrations, and the greateſt motion is at *q*, *m*, *q* Fig. 15. and hardly to be perceived at *p*, *p*; ſo that, in ſhort, this experiment holds, when any note is ſtruck, which is an uniſon to half the ſtring, and a 12th to a third part thereof: In this caſe (the vibrations of the equal parts of a ſtring being ſynchronical) there is no contrariety in the motion to hinder each other; whereas it is otherwiſe, if a note is uniſon to S, Fig. 16. that does not divide the ſtring into equal

equal parts; for then the vibrations of the remainder *r*, not ſuiting with thoſe of the other parts, immediately make a confuſion in the whole: Now in the trumpet-marine, you do not ſtop cloſe as in other inſtruments, but touch the ſtring gently with your thumb, whereby there is a mutual concurrence of the upper and lower parts of the ſtring to produce the ſound; which is ſufficiently evident from this, that if any thing touch the ſtring below the ſtop, the ſound will be as effectually ſpoiled, as if it were laid upon that part, which is immediately ſtruck with the bow; from hence therefore we may collect, that the trumpet-marine yields no muſical ſound, but when the ſtop makes the upper part of the ſtring an aliquot of the remainder, and conſequently of the whole; otherwiſe, as was juſt now remarked, the vibrations of the parts will ſtop each other, and make a ſound, ſuitable to their motion, altogether confuſed: Now, that theſe aliquot parts are the very ſtops, which produce the trumpet-notes, will be plainly ſhewn in the treating of the 2d enquiry; *viz.* what is the reaſon that the 7th, 11th, 13th, 14 notes are out of tune, and the reſt exactly in tune.

All writers on the arithmetical part of muſick agree,

That by ſhortening a ſtring { half, a third part, a fourth, a fifth, a ſixth } The ſound is raiſed { an eighth, a fifth, a fourth, a ſharp third, a flat third }

From this foundation all the other notes are derived; the flat and ſharp ſixth are to be the flat and ſharp third to the fourth, and the 7th the like to the fifth; the ſecond to be a fifth to the fourth below, *&c.* By this rule let us examine what notes a monochord fretted in its aliquot parts will produce; ſuppoſe the monochord F Fig. 17. to conſiſt of 720 parts, and its tone double C-fa-ut, the firſt note in the table; then half of it will be 363, and a third part 240, *&c.* Now I ſay, fretting (or ſtopping with the thumb) at 360 muſt produce C-fa-ut; becauſe 360 being half 720, the ſound will riſe an eighth from double C-fa-ut; Again 360 being C-fa-ut, 240 muſt make G-ſol-re-ut the third note in the table; becauſe 240 being juſt a third part leſs than 360, the ſound will riſe a fifth from that note; after the ſame manner proceeding ſtep by ſtep it will be evident that,

180	240	a fourth		C-ſol-fa-ut	the 4th
144	180	a fifth		E-la-mi	5th
120	144	a ſixth		G-ſol-re-ut	6th
90	180	half		C-ſol-fa	8th
80	120	a third		D-la-ſol	9th
72	90	a fifth		E-la	10th
60	90	a third		G-ſol-re ut	12th
48	60	a fifth		B-fa-b-mi	15th
45	90	half		C-ſol-fa	16th

which is leſs than — by juſt — produces — Note in the Table

By the ſame reaſon,

100		120		a 6th	B-fa-b-mi-flat
67½	which	90	by juſt	4th	F-fa-ut
54	is leſs	67½		5th	A-la-mi-ré
50	than	100		half	B-fa-b-mi-flat

produces

And conſequently,

102⅔	the 7th		flatter		B-fa-b-mi-flat
65 1/11	11th	Note in the Table, is a little	ſharper	than	F-fa-ut
55 5/13	13th		flatter		A-la-mi-re
51⅔	14th		flatter		B-fa-b-mi-flat

Which anſwers the ſecond inquiry.

Now to apply this to the trumpet, where the notes are produced only by the different ſtrength of the breath, it is reaſonable to imagine that the ſtrongeſt blaſt raiſes the ſound by breaking the air within the tube into the ſhorteſt vibrations, but that no muſical note will ariſe, unleſs they are ſuited to ſome aliquot part, and ſo by reduplication exactly meaſure out the whole length of the inſtrument as in Fig. 15. for otherwiſe a remainder will cauſe the ſame inconvenience in this caſe, as in Fig. 16. to which if we add, that in a pipe, which is ſhortened according to the proportions juſt now diſcourſed of in a ſtring, the ſound is raiſed in the ſame ratio, it renders the caſe of the trumpet exactly the ſame with the monochord.

For a corollary to this diſcourſe, we may obſerve that the diſtances of the trumpet notes, aſcending continually, decreaſed in the ratio of $\frac{1}{1}, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$, *in infinitum*; for,

The { ſecond / third / fourth, &c. } note in the table differs from the { firſt / ſecond / third, &c. } by { ½ / ⅓ / ¼ } of the ſtring &c.

The

The Cauſe of the change of the Variation of the Magnetical Needle, *with an Hypotheſis of the Structure of the internal parts of the* Earth; *by Mr.* Edm. Halley. Phil. Tranſ. N° 195. p. 563.

MR. *Halley*, in his theory of the variation of the magnetical needle, came at length to this general concluſion; *viz.* that the globe of the earth might be ſuppoſed to be one great magnet, with four magnetical poles or points of attraction, two of them near each pole of the *Equator*; and that in thoſe parts of the world, which lie near any of thoſe magnetical poles, the needle is chiefly governed thereby, the neareſt pole being always predominant over the more remote; and he there endeavoured to ſtate and limit the preſent poſition of thoſe poles on the ſurface of our globe; yet he found two difficulties not eaſily to be ſurmounted; the one was, that no magnet, he had ever ſeen or heard of, had more than two oppoſite poles, whereas the earth had viſibly four, and perhaps more; ſecondly, it was plain, that theſe poles were not, at leaſt all of them, fixed in the earth, but ſhifted from place to place, as appeared by the great changes in the needle's direction within this laſt century of years; not only at *London*, where this great diſcovery was firſt made, but almoſt all over the globe of the earth; whereas it is not known, or obſerved, that the poles of a load-ſtone ever ſhifted their place in the ſtone, nor, conſidering the compactneſs of its ſubſtance, can it eaſily be ſuppoſed: Theſe difficulties made the author quite deſpair of ever being able to account for this phænomenon, when in an accidental converſation he lighted on the following hypotheſis: It is ſufficiently known and allowed, that the variation of the needle changes, but that this change is gradual and univerſal will appear by the following examples; at *London* in 1580, the variation was obſerved by Mr. *Burrows* to be 11° 15′ to the eaſt; in 1622, the ſame was found by Mr. *Gunter* to be only 6° to the eaſt; in 1634, Mr. *Gellibrand* obſerved it 4° 5′ to the eaſt; in 1657, Mr. *Bond* obſerved that there was no variation at *London*; in 1672, Mr. *Halley* himſelf obſerved it 2° 30′ to the weſt; ſo that in 112 years the direction of the needle has changed no leſs than 17 degrees: At *Paris*, *Orontius Finæus* about the year 1550, reckoned about 8 or 9° eaſt variation; in 1640, it was found 3° to the eaſt; in 1666, there was no variation there, and 1681 it was found to be 2° 30′ to the weſt: At *Cape d' Agulhas*, the moſt ſoutherly promontory of *Africa*, about the year 1600, the needle pointed due north and ſouth without variation, whence

the *Portugueze* gave it that name; in 1622 there were 2° west variation; in 1675 it was 8° 00′ to the west; and in 1691 it was curiously observed to be no less than 11° to the west: At St. *Helena*, about the year 1600, the needle declined 8° to the east; in 1623, it was but 6° 00′ to the east; in 1677, when Mr. *Halley* was there, he accurately observed it on shore to be 0° 40′ east; and in 1692 it was found about 1° to the westward of the north: At *Cape Comorin* in 1620, there were 14° 20′ westerly variation; in 1680, there were 8° 48′, but in 1688, it was no more than 7° 30′; so that here, the needle has returned to the east about 7° in 70 years: From these and many other observations it is evident, that the direction of the needle is in no place fixed and constant, tho' in some it changes faster than in others; and where for a long time it has continued, as it were, unalterable, it is there to be understood, that the needle has its greatest deflection, and is become stationary, in order to return, like the sun in the *Tropics*; this at present, *viz.* 1692, is in the *Indian Sea*, about the island *Mauritius*, where is the highest westerly variation, and in a tract tending from thence to the N. N. W. towards the *Red Sea* and *Egypt*; and in all places to the westward of this tract, all over *Africa* and the adjoining seas, the westerly variation will be found to have encreased; and to have decreased to the eastward thereof, as in the example of *Cape Comorin*, all over the *East-Indies* and the islands near it: In like manner, in that space of easterly variation, which, beginning near St. *Helena*, is found all over south *America*, and which at present is highest about the mouth of *Rio de la Plata*, it hath been observed, that in the eastern parts thereof, the variation of the needle gradually decreases; and by analogy we may infer, tho' we have not experience enough to ascertain it, that both the easterly and westerly variations in the *Pacific Sea*, do gradually encrease and decrease after the same rule: These phænomena, being well understood, and duly considered, do sufficiently evince, that the whole magnetical system hath one, or perhaps more motions; that the moving force is very great, as extending its effects from pole to pole; and that the motion thereof is not *per saltum* but by a gradual and regular motion: Now, considering the structure of our terraqueous globe, it cannot be well supposed that a very great part thereof can move within it, without notably changing its centre of gravity and the equilibrium of its parts, which would produce very wonderful effects in changing the axis of diurnal rotation, and occasion strange alterations in the surface of the sea, by inundations and recesses thereof, such as history never

yet

yet mentioned; beſides, the ſolid parts of the earth are not to be ſuppoſed permeable by any other than fluid ſubſtances, of which we know none that are any ways magnetical; ſo that the only way to render this motion intelligible and poſſible, is, to ſuppoſe it to turn about the centre of the globe, having its centre of gravity fixed and immoveable in the ſame common centre of the earth; and there is yet required, that this moving internal ſubſtance be looſe and detached from the external parts of the earth, whereon we live; for otherwiſe were it affixed thereto, the whole muſt neceſſarily move together: So then the external parts of the globe may well be reckoned as the ſhell, and the internal as a *Nucleus*, or inner globe included within ours, with a fluid medium between, which, having the ſame common centre and axis of diurnal rotation, may turn about with our earth each 24 hours; only this outer ſphere, is to have its turbinating motion either ſomewhat ſwifter or ſlower than the internal ball; and even the difference of a minute in length of time, by many repetitions becoming ſenſible, the internal parts will by degrees recede from the external, and not keeping pace with each other, will appear gradually to move either to the eaſt or weſt by the difference of their motions: Now ſuppoſing ſuch an internal ſphere having ſuch a motion, we may reſolve the two great difficulties in the hypotheſis of the variation; for if this external ſhell of earth be a magnet, having its poles at a diſtance from the poles of diurnal rotation; and if the internal *Nucleus* be likewiſe a magnet, having its poles in two other places diſtinct alſo from the axis; and theſe latter by a gradual and ſlow motion change their place in reſpect of the external, we may then give a reaſonable account of the four magnetical poles, as likewiſe of the changes of the variations of the needle: The period of this motion being wonderfully great, and there being hardly a century ſince theſe variations have been duly obſerved, it will be very hard to bring this hypotheſis to a *Calculus*, eſpecially ſince, tho' the variations do encreaſe and decreaſe regularly in the ſame place, yet in different places, at no great diſtance, there are found ſuch caſual changes thereof, as can no ways be accounted for by a regular hypotheſis, as depending upon the unequal and irregular diſtribution of the magnetical matter within the ſubſtance of the external ſhell or coat of the earth, which deflects the needle from the poſition it would acquire from the effect of the general magnetiſm of the whole; of this the variations at *London* and *Paris* afford a notable inſtance; for the needle has been conſtantly about 1 ½ degree more eaſterly at *Paris* than at *London*,

tho' it be certain, according to the general effect, the difference ought to be the contrary way; notwithſtanding which, the variations in both places do change alike: Hence and from ſome other of the like nature, Mr. *Halley* concludes, that the two poles of the external globe are fixed in the earth, and that if the needle were wholly governed by them, the variations thereof would be always the ſame with ſome little irregularities on the account juſt now mentioned; but the internal ſphere, having ſuch a gradual tranſlation of its poles, does influence the needle, and direct it variouſly, according to the reſult of the attractive or directive power of each pole; and conſequently there muſt be a period of the revolution of this internal ball, after which the variation will return again as before; but if it ſhall in future ages be obſerved otherwiſe, we muſt then conclude, that there are more of theſe internal ſpheres, and more magnetical poles than four, which at preſent we have not a ſufficient number of obſervations to determine, and particularly in that vaſt *Mare del Zur*, which occupies ſo great a part of the whole ſurface of the earth: If then two of the poles be fixed, and two moveable, it remains to aſcertain, which they are that keep their place, and Mr. *Halley* thinks we may ſafely determine that our *European* north pole, ſuppoſed to be near the meridian of the *Land's End*, and about 7° therefrom, is that of the two northern poles which is moveable, and which hath chiefly influenced the variations in theſe parts of the world; for in *Hudſon's Bay*, which is under the direction of the *American* pole, the change is not obſerved to be near ſo faſt as in theſe parts of *Europe*, tho' that pole be much farther removed from the axis; from the like obſervation of the ſlow decreaſe of the variation on the coaſt of *Java* and near the meridian of the *Aſian* pole, this latter, of the two ſouth poles, is fixed, and conſequently, the *American* moveable: If this be allowed, it is plain, that the fixt poles are the poles of this external ſhell or *Cortex* of the earth, and the other two the poles of a magnetical *Nucleus* included and moveable within the other; it likewiſe follows, that this motion is to the weſt, and conſequently that the aforeſaid *Nucleus* has not preciſely attained the ſame degree of velocity with the exterior parts in their diurnal revolution, but ſo very nearly equals it, that in 365 revolutions the difference is ſcarcely ſenſible; this is conceived to ariſe from the impulſe, whereby this diurnal motion was impreſſed on the earth, being given to the external parts, and from thence in time communicated to the internal; but not ſo, as perfectly to equal the velocity of the firſt motion impreſſed on, and ſtill conſerved

ſerved by the ſuperficial parts of the globe: As to the quantity of this motion, it is almoſt impoſſible to define it, both from the nature of this kind of obſervation, which cannot be very accurately performed; as alſo, from the ſmall time theſe variations have been obſerved in, and their changes diſcovered: The period of this motion appears by all circumſtances, to conſiſt of many centuries of years, and conſidering the change of the place, where there was no variation, by reaſon of the equilibrium of the two ſouthern magnetical poles, *viz.* from cape *d'Agulhas* to the meridian of St. *Helena* (which is about 23° in about 90 years) and of the place where the weſterly variation is in its greateſt deflection, being about half ſo much; *viz.* from the iſland of *Diego Roiz* to the ſouth-weſt parts of *Madagaſcar*, we may with ſome reaſon conjecture, that the *American* pole was moved weſtwards 46° in that time, and that the whole period thereof is performed in 700 years, or thereabouts; ſo that the nice determination of this, and of ſeveral other particulars in the magnetic ſyſtem is reſerved for later poſterity: By the way, it will not be amiſs to correct a received error in the practice of obſerving the variation, which is, to take it by the amplitude of the riſing and ſetting ſun, when his centre appears in the viſible horizon, whereas he ought to be obſerved, when his under limb is ſtill above the horizon about $\frac{1}{2}$ of his diameter, or 20 minutes, on account of the refraction, and the height of the eye of the obſerver above the ſurface of the ſea; or elſe the amplitudes are to be wrought as the azimuths, reckoning the ſun's diſtance from the zenith 90° 36'; this, tho' of little conſequence near the *Equator*, will make a great error in high latitudes, where the ſun riſes and ſets obliquely: But to return to our hypotheſis, in order to explain the change of the variations, we have adventured to make the earth hollow, and to place another globe within it; and no doubt it will be objected, that there is no inſtance in nature of the like thing; that if there were ſuch a middle globe, it would not keep its place in the centre, but be apt to deviate therefrom, and might poſſibly ſhock againſt the concave ſhell, to the ruin, or at leaſt endamaging thereof; that the waters of the ſea would perpetually ſoak thro', unleſs we ſuppoſe the cavity full of matter; that were it poſſible, yet it does not appear of what uſe ſuch an inward ſphere can be of, being ſhut up in eternal darkneſs, and therefore unfit for the production of animals or plants: Briefly to anſwer theſe and all other objections, and firſt, the ring invironing the globe of *Saturn* is a notable inſtance, as having the ſame common centre, and moving along with the planet, without ſenſibly approach-

approaching him on one ſide more than the other; and if this ring were turned round on one of its diameters, it would then deſcribe ſuch a concave ſphere, as the external one of the earth is ſuppoſed to be; and ſince the ring, in any given poſition, would in the ſame manner retain the centre of *Saturn* in its own, it follows, that ſuch a concave ſphere may move with another included in it, having the ſame common centre; nor can it well be ſuppoſed otherwiſe, conſidering the nature of gravity; for ſhould theſe globes be adjuſted once to the ſame common centre, the gravity of the parts of the concave would preſs equally towards the centre of the internal ball, which equality muſt neceſſarily continue till ſome external force diſturbs it, which is not eaſy to imagine in our caſe; this perhaps might more intelligibly be expreſſed, by ſaying that the inner globe, being poſited in the centre of the exterior, muſt neceſſarily aſcend, which way ſoever it move; that is, it muſt overcome the force of gravity preſſing towards the common centre, by an impulſe it muſt receive from ſome external agent; but all outward efforts being ſufficiently fenced againſt by the ſurrounding ſhell, it follows, that this *Nucleus*, being once fixed in the common centre, muſt always remain there: As to the leaking of the water thro' this ſhell, when there is once a paſſage for it to run thro', is an objection ſeemingly of weight; but when we conſider, how tightly great beds of chalk or clay, and much more ſtone, do hold water, and even caves arched with ſand, no man can doubt but the wiſdom of the creator hath provided for the macrocoſm, by many other ways than can be imagined or expreſſed, eſpecially ſince we ſee the admirable and innumerable contrivances, wherewith each meaneſt individual is furniſhed, both for its own defence, and the propagation of its ſpecies; what curioſity in the ſtructure, what accuracy in the mixture and compoſition of the parts ought we not to expect in the fabric of this globe, deſigned for the laſting habitation of ſo many various ſpecies of animals, in each of which there want not many inſtances, that manifeſt the boundleſs power and goodneſs of their divine author? And can we then think it a hard ſuppoſition, that the internal parts of this earth ſhould be replete with ſuch ſaline and vitriolic particles as may contribute to petrifaction, and diſpoſe the tranſuding water to ſhoot and coagulate into ſtone, ſo as continually to fortify, and if need were, to conſolidate any breach or flaw in the concave ſurface of the ſhell? And this perhaps may, not without reaſon, be ſuppoſed to be the final cauſe of the admixture of the magnetical matter in the maſs of the terreſtrial parts of our globe; *viz.* to

ſtrengthen

ſtrengthen and maintain the concave arch of this ſhell; for by what the excellent Mr. *Newton* hath ſhewn in his *Principia Philoſophiæ*, it will follow, that according to the general principle of gravity, viſible throughout the whole univerſe, all thoſe particles, that by length of time, or otherwiſe, ſhall moulder away, or become looſe on the concave ſurface of the external ſphere, would fall in, and with great force deſcend on the internal, unleſs thoſe particles were of another ſort of matter capable by their ſtronger tendency to each other, to ſuſpend the force of gravity; but we know no other ſubſtances capable of ſupporting each other by their mutual attraction, but the magnetical; and theſe we obſerve miraculouſly to perform that office, even where the power of gravity hath its full effect, much more within the globe, where it is weaker; why then may we not ſuppoſe, the ſaid arches to be lined throughout with a magnetical matter, or rather to be one great concave magnet, whoſe two poles, are thoſe before obſerved, to be fixed in the ſurface of our globe: Another argument, favouring this hypotheſis, is drawn from a propoſition of the aforeſaid Mr. *Newton*, where he determines the force, wherewith the moon moves the ſea in producing the tides; where he ſays, the denſity of the moon is to that of the earth as 680 to 387, or as 9 to 5 nearly; therefore, the body of the moon is denſer than our earth; now, if the moon be more ſolid than the earth, as 9 to 5, why may we not reaſonably ſuppoſe the moon being a ſmall body, and a ſecondary planet, to be ſolid earth, water and ſtone; and this globe to conſiſt of the ſame materials, only four ninths thereof to be porous within, and between the internal ſpheres? It muſt be allowed indeed, that theſe included globes can be of very little ſervice to the inhabitants of this outward world, nor can the ſun be ſerviceable to them either with his light or heat; but ſince we ſee all the parts of the creation abound in animate things, why ſhould we think it ſtrange, that the prodigious maſs of matter, of which this globe conſiſts, ſhould be capable of ſome other improvements, than barely to ſerve to ſupport its ſurface? Why may we not rather ſuppoſe, that the exceeding ſmall quantity of ſolid matter, in reſpect to the fluid *Æther*, is ſo diſpoſed by the Almighty wiſdom, as to yield as great a ſurface for the uſe of living creatures, as can conſiſt with the conveniency and ſecurity of the whole? And tho' without light there can be no living, yet there are many ways of producing light, which we are wholly ignorant of; the medium itſelf may be always luminous, after the manner of our *Ignes fatui*; the concave arches may in ſeveral places ſhine with ſuch a ſubſtance as inveſts the ſurface of the ſun; nor

can

can we, without raſhneſs, unbecoming philoſophers, adventure to aſſert the impoſſibility of peculiar luminaries below, of which we have no manner of idea.

For the farther explication of this ſubject, the following ſcheme is ſubjoined, wherein, Fig. 1. Plate II. the earth is repreſented by the external circle, and the three internal circles are made nearly proportionable to the magnitudes of the planets *Venus*, *Mars*, and *Mercury*, all which may be included within the globe of the earth, and all the arches be more than ſufficiently ſtrong to bear their weight; the concavity of each arch, which is ſhaded differently from the reſt, is ſuppoſed to be made up of magnetical matter, and the whole to turn about the ſame common axis *p p*, only with this difference, that the outer ſphere ſtill moves ſomewhat faſter than the inner; thus, the diameter of the earth being about 8000 *Engliſh* miles, Mr. *Halley* allows 500 miles for the thickneſs of its ſhell, and another ſpace of 500 miles for an interveening medium, capable of an immenſe atmoſphere for the uſe of the globe of *Venus*; to *Venus* again he allows a ſhell of the ſame thickneſs, and he leaves as great a ſpace between her concavity and *Mars*; ſo likewiſe from *Mars* to *Mercury*, which latter ball he ſuppoſes ſolid, and about 2000 miles in diameter: A farther uſe of this cavity of the earth, may be to diminiſh the ſpecific gravity thereof in reſpect of the moon; for the oppoſition of the *Æther*, to the motions of the planets, in a long time becomes ſenſible, and conſequently the greater body muſt receive a leſs oppoſition than the ſmaller, unleſs the ſpecific gravity of the leſſer doth proportionably exceed that of the greater, in which caſe only they can move together; ſo that the cavity in the earth may well ſerve to adjuſt its weight to that of the moon; for otherwiſe the earth would leave the moon behind it, and ſhe become another primary planet.

The Proceſs of making the Phoſphorus; *by Mr.* Boyle. Phil. Tranſ. N° 196. p. 583.

THERE was taken a conſiderable quantity of human urine, becauſe it yields but a ſmall proportion of the deſired quinteſſence, and a good part of it at leaſt, had been digeſted for a pretty while, before it was uſed; then this liquor was diſtilled with a moderate heat, till the ſpirituous and ſaline parts were drawn off; after which, the ſuperfluous moiſture was alſo evaporated, till the remaining ſubſtance was brought to the conſiſtence of a ſomewhat thick ſyrup, or a thin extract; this done, it was well incorporated with thrice its weight of fine white ſand; and the

Fig. I.

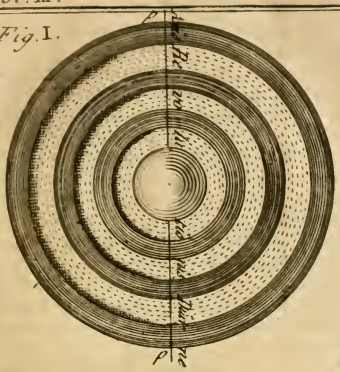


Fig. II.

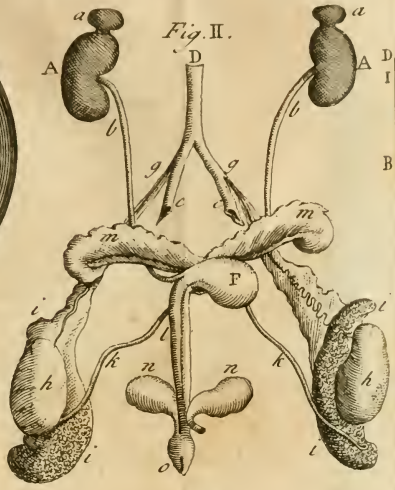


Fig. III.

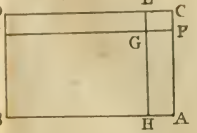


Fig. VIII.

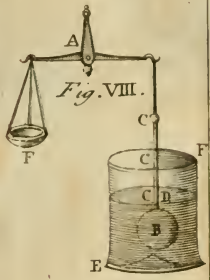


Fig. VI.

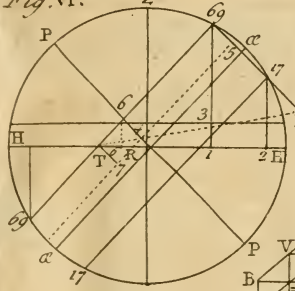


Fig. VII.

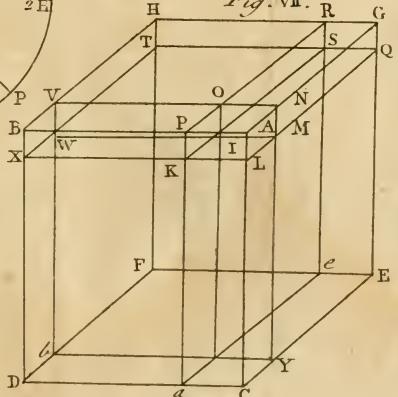


Fig. V.

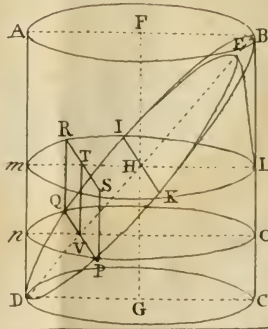
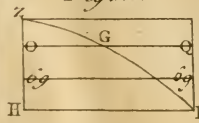


Fig. IV.



the mixture being put into a ſtrong ſtone-retort, to which a large receiver, in a great meaſure filled with water, was ſo joined, that the noſe of the retort did almoſt touch the water; then the two veſſels being carefully luted together, a naked fire was gradually adminiſtered for five or ſix hours, that what was either phlegmatic or volatile might come over firſt; when this was done, the fire was encreaſed, and at laſt, for five or ſix hours made as ſtrong and intenſe, as the furnace was capable of giving; which violence of the fire, is a circumſtance not to be omitted in this operation; by this means there came over a great deal of white fumes, almoſt like thoſe that appear in the diſtillation of the oil of vitriol, and when theſe fumes were over, and the receiver appeared clear, they were, in a little time, ſucceeded by another ſort, which ſeemed in the receiver to yield a faint blueiſh light, almoſt like that of little burning matches dip'd in ſulphur; and laſt of all, the fire being very vehement, there came over another ſubſtance, that was thought more ponderous than the former, becauſe it fell thro' the water to the bottom of the receiver; whence being taken out (and partly even whilſt it continued therein) it appeared by ſeveral effects, and other phænomena to be ſuch a ſubſtance as was deſired and expected.

Obſervations on the Diſſection of a Rat; *by Mr.* Rich. Waller. Phil. Tranſ. N° 196. p. 594.

THE fore feet of a rat reſemble thoſe of the caſtor, or beaver; the hair, as in that animal, is alſo ſome of it fine, and ſome coarſe; the tail ſcaly, with hairs between every ſcale, like the caſtor; which ſhew that thoſe two animals have ſome reſemblance to each other; and indeed the water-rat comes very near the beaver, and makes its holes in the banks and ponds, after the ſame manner: The *Penis* in the rat hath a particular paſſage near the navel, as in ſquirrels, and not at the *Anus*, as in the caſtor; the liver is full of little ſpecks, as big as pins heads, which are the ſmall glands; there was no gall-bladder, only a *Ductus Felleus*; poſſibly the bladder was incloſed in the *Parenchyma* of the liver, as it is in ſome animals; the *Cæcum* was much larger than the ſtomach, and in ſhape like that of the caſtor; the teſticles lay not behind, but in the groins on the *Os Pubis*; theſe were like a bottom, or ſkean of thread rumpled up together, which was viſible thro' the coats of the teſticle; this thread continued of near the ſame ſize in the *Epididymides*, only towards the *Deferentia* it grew larger; it was tender, and not eaſily unravelled, ſo that not above $\frac{3}{4}$ of a yard could be drawn out; the *Proſtatæ* lay under

the ſpermatick arteries; the kidneys were whitiſh with their *Succenturiati*; at the neck of the bladder were inſerted the *Veſiculæ Seminales*, which were tranſparent and filled with *Semen*; towards the end of the *Penis*, which had a bony griſtle, were two large glands emptying themſelves near the extremity of the *Penis*, and containing a ſubſtance like cream, as in the dormouſe, obſerved by *Swammerdam*.

A A, Fig. 2. Plate II. the kidneys; *a a* the *Renes Succenturiati*; *b b* the *Ureters*; *c c* the crural veins and arteries; *d* the *Arteria Magna*; *e* the *Vena Cava*; *f* the bladder; *g g* the ſpermatick veſſels, both veins and arteries; *h h* the *Teſtes*, with the branches of the veins and arteries; *i i* the *Epididymides*; *k k* the *Deferentia*; *l l* the *Penis*; *m m Veſiculæ Seminales*; *n n* two glands from whence a thick juice might be expreſſed; *o* the *Balanus* or glans.

An Eſtimate of the Degrees of Mortality *of* Mankind *drawn from Tables of* Births *and* Burials *in the City of* Breſlaw, *with an Attempt to aſcertain the Price of* Annuities *on* Lives; *by Mr.* Edm. Halley. Phil. Tranſ. N° 196. p. 596.

THE contemplation of the mortality of mankind, hath beſides a moral, its phyſical and political uſes: The deductions made from the bills of mortality of *London* and *Dublin* ſeemed to be defective; firſt in that the number of the people was not known; ſecondly, that the ages of thoſe that died was not mentioned; and laſtly that both *London* and *Dublin*, by reaſon of the great and caſual acceſſion of ſtrangers who die therein, as appeared by the great exceſs of the funerals above the births, rendred them unfit to be ſtandards for this purpoſe; which require, if poſſible, that the people, we treat of, ſhould not at all be changed, but die where they were born, without any adventitious encreaſe from abroad, or decay by migration elſewhere: This defect ſeems in great meaſure to be ſupplied by the curious tables of the bills of mortality in the city of *Breſlaw*; wherein both the ages and ſexes of thoſe that die, are monthly delivered, and compared with the number of the births for five Years, *viz.* 1687, 88, 89, 90, 91; and it ſeems to be executed with all poſſible exactneſs and fidelity: *Breſlaw* is the capital city of the province of *Sileſia*, or as the *Germans* pronounce it, *Schleſie*, and it is ſituated on the weſtern bank of the *Oder*, anciently called *Viadrus*, near the confines of *Germany* and *Poland*, and nearly in the ſame latitude with *London*; it is very far from the ſea, whence the confluence of ſtrangers is but ſmall, and the manufacture of linnen employs chiefly

chiefly the poor people of the place, as well as of the country round about; whence comes that ſort of linnen, uſually called *Scleſie* linnen; which is the chief, if not the only commodity of the place: For theſe reaſons, the people of this city ſeem moſt proper for a ſtandard; and the rather, becauſe the births do a ſmall matter exceed the funerals; the only thing wanting is the number of the whole people, which Mr. *Halley* hath endeavoured to ſupply by compariſon of the mortality of people of all ages; and it appears that in five years; *viz.* from 87 to 91 incluſive, there were born 6193 perſons, and buried 5169; that is, born *per Annum* 1238, and buried 1174; whence an encreaſe of 64 *per Annum* may be argued, or of about a 20th part, which may perhaps be balanced by the levies for the emperor's ſervice; but this being contingent, and the births certain, Mr. *Halley* ſuppoſes the people of *Breſlaw* to be encreaſed by 1238 births annually; of theſe it appears by the ſame tables, that 348 do yearly die in the firſt year of their age, and that but 890 do arrive at a full year's age; and likewiſe, that 198 die in the 5 years between 1 and 6 complete, taken at a mean, ſo that only 692 of the perſons born, do ſurvive 6 whole years; from this age, the infants being arrived at ſome degree of firmneſs, grow leſs and leſs mortal; and it appears, that of the whole people of *Breſlaw*, there die yearly, as in the following table; wherein, the upper line ſhews the age; and the next under it, the number of perſons, of that age, dying yearly.

| | | |

from 25 to 50 there ſeem to die from 7 to 8 and 9 *per Annum* of each age; and after that to 70, they growing more decrepit, tho' the number be much diminiſhed, yet the mortality encreaſes, and there are found to die 10 or 11 of each age *per Annum*; from thence the number of the living becoming very ſmall, they gradually decline, 'till there be none left to die, as may be ſeen at one view in the table.

From theſe conſiderations, Mr. *Halley* formed the annexed table, whoſe uſes are manifold, and which gives a juſter idea of the ſtate and condition of mankind, than any thing of the kind yet extant; it exhibits the number of people in the city of *Breſlaw* of all ages, from the birth to extreme old age, and thereby ſhews the chances of mortality at all ages; and likewiſe, how to make a certain eſtimate of the value of annuities for lives, which hitherto hath been only done by an imaginary valuation; alſo the chances that there are, that a perſon of any age propoſed, does live to any other age given: The following table, ſhews the number of perſons living in the age current annexed thereto.

Age. Curt	Per-ſons	Age Curt	Per ſons	Age Curt	Per ſons	Age Curt	Per ſons	Age Curt	Per ſons	Age Curt	Per ſons
1	1000	8	680	15	628	22	586	29	539	36	481
2	855	9	670	16	622	23	579	30	531	37	472
3	798	10	661	17	616	24	573	31	523	38	463
4	760	11	653	18	610	25	567	32	515	39	454
5	732	12	646	19	604	26	560	33	507	40	445
6	710	13	640	20	598	27	553	34	499	41	436
7	692	14	634	21	592	28	546	35	490	42	427
Age. Curt	Per-ſons	Age Curt	Per ſons	Age Curt	Per ſons	Age Curt	Per ſons	Age Curt	Per ſons	Age Curt	Per ſons
43	417	50	346	57	272	64	202	71	131	78	58
44	407	51	335	58	262	65	192	72	120	79	49
45	397	52	324	59	252	66	182	73	109	80	41
46	387	53	313	60	242	67	172	74	98	81	34
47	377	54	302	61	232	68	162	75	88	82	28
48	367	55	292	62	222	69	152	76	78	83	23
49	357	56	282	63	212	70	142	77	68	84	20

Age.	Perſons
7	5547
14	4584
21	4270
28	3964
35	3604
42	3178
49	2709
56	2194
63	1694
70	1204
77	692
84	253
100	107
	34000
	Sum Total.

Thus it appears, that the whole people of *Breſlaw* conſiſt of 34000 ſouls, being the ſum total of the perſons of all ages in the table; whoſe firſt uſe is to ſhew the proportion of men able to bear arms,

arms, which are thoſe between 18 and 56, rather then 16 and 60; the one being generally too weak to bear the fatigues of war, and the weight of arms, and the others too decrepit and infirm by age, notwithſtanding particular inſtances to the contrary; By the table there are found in this city 11997 perſons under 18, and 3950 above 56, which together make 15947, ſo that the remainder to 34000 being 18053 are perſons between thoſe ages; at leaſt one half are males, or 9027, ſo that the whole number, this city can raiſe, of *Fencible Men*, as the *Scots* call them, is about 9000, or $\frac{2}{3}\frac{1}{4}$, or ſomewhat more than a quarter of the number of ſouls; which may perhaps paſs for a rule in all other places.

The ſecond uſe of this table is to ſhew the different degrees of mortality, or rather vitality in all ages; for if the number of perſons of any age, remaining after one year, be divided by the difference between that and the number of the age propoſed, it ſhews the odds there is, that a perſon of that age does not die in a year; as for inſtance a perſon of 25 years of age has the odds of 560 to 7, or 80 to 1, that he does not die in a year; becauſe that of 567 living of 25 years of age, there die no more than 7 in a year, leaving 560 of 26 years old; ſo likewiſe for the odds, that any perſon does not die before he attain any propoſed age, take the number of the remaining perſons of the age propoſed, and that ſhews the odds there is between the chances of the party's living or dying; as for inſtance, what is the odds that a man of 40 lives 7 years; take the number of perſons of 47 years, which in the table is 377, and ſubſtract it from the number of perſons of 40 years, which is 445, and the difference is 68; which ſhews that the perſons dying in that 7 years are 68, and that it is 377 to 68 or $5\frac{1}{2}$ to 1, that a man of 40 does live 7 years; and the like for any other number of years.

The third uſe, if the queſtion be, at what number of years it is an even lay that a perſon of any age ſhall die, this table readily performs it; for if the number of perſons living of the age propoſed be halved, it will be found by the table at what year the ſaid number is reduced to half by mortality, and that is the age, to which, it is an even wager, that a perſon of the age propoſed ſhall arrive before he die: As for inſtance, a perſon of 30 years of age is propoſed, the number of that age is 531, the half thereof is 265, which number is found to be between 57 and 58 years; ſo that a man of 30 may reaſonably expect to live between 27 and 28 years.

Uſe fourth, by what has been ſaid, the price of inſurance upon lives ought to be regulated, and the difference between the price of

of inſuring the life of a man of 20 and 50 is diſcovered; for inſtance, it is 100 to 1, that a man of 20 dies not in a year, and but 38 to 1 for a man of 50 years of age.

Uſe fifth, on this depends the valuation of annuities upon lives; for it is plain that the purchaſer ought to pay for only ſuch a part of the value of the annuity, as he has chances that he is living; and this ought to be computed yearly, and the ſum of all thoſe yearly values, being added together, will amount to the value of the annuity for the life of the perſon propoſed; now the preſent value of money payable after a term of years, at any given rate of intereſt, may be had either from tables already computed, or almoſt as compendiouſly, by the table of logarithms; for the arithmetical complement of the logarithm of unity and its yearly intereſt (that is, of 1, 06, at *6 per Cent.* being 9. 974694) being multiplied by the number of years propoſed, gives the preſent value of one pound payable at the end of ſo many years; then by the foregoing propoſition, it will be as the number of perſons living after that term of years, to the number dead, ſo are the odds that any one perſon is alive or dead; and conſequently, as the ſum of both, or the number of perſons living of the age firſt propoſed, to the number remaining after ſo many years (both given by the table) ſo the preſent value of the yearly ſum payable after the term propoſed, to the ſum which ought to be paid for the chance the perſon has to enjoy ſuch an annuity after ſo many years; and this being repeated for every year of the perſon's life, the ſum of all the preſent values of thoſe chances is the true value of the annuity; and the following table ſhews the value of annuities for every fifth year of age to the 70th.

Age	Year's Pur.	Age	Year's Pur.	Age	Year's Pur.
1	10,28	25	12,27	50	9,21
5	13,40	30	11,72	55	8,51
10	13,44	35	11,12	60	7,60
15	13,33	40	10,57	65	6,54
20	12,78	45	9,91	70	5,32

Uſe ſixth, two lives are likewiſe to be valued by the ſame rule; for the number of chances of each ſingle life, found in the table, being multiplied together, become the chances of the two lives; and after any certain term of years, the product of the two remaining ſums is the chances that both the perſons are living; the product of the two differences, being the numbers of the dead

dead of both ages, are the chances that both the perſons are dead; and the two products of the remaining ſums of the one age multiplied by thoſe dead of the other, ſhew the chances there are that each party ſurvives the other; whence is derived the rule to eſtimate the value of the remainder of one life after another: Now as the product of the two numbers in the table for the two ages propoſed, is to the difference between that product, and the product of the two numbers of perſons deceaſed in any ſpace of time, ſo is the value of a ſum of money to be paid after any time propoſed, to the value of the chances, that the one party has, that he ſurvives the other, whoſe number of deceaſed you made uſe of, in the ſecond term of the proportion: This perhaps may be better underſtood, by putting N for the number of the younger age, and n for that of the elder; Y, y the deceaſed of both ages reſpectively, and R, r for the remainders; and $R + Y = N$, and $r + y = n$; then Nn will be the whole number of chances; $Nn - Yy$ be the chances that one of the two perſons is living, Yy the chances that they are both dead; Ry the chances that the elder is dead and the younger living; and rY the chances that the elder is living and the younger dead: Thus two perſons of 18 and 35 are propoſed, and after 8 years theſe chances are required; the numbers for 18 and 35 are 610 and 490, and there are 50 of the firſt age dead in 8 years and 73 of the elder; there are in all 610×490 or 298900 chances, of theſe there are 50×73, or 3650 that they are both dead; and as 298900 is to $298900 - 3650$, or 295253, ſo is the preſent value of a ſum of money to be paid after 8 years, to the preſent value of a ſum to be paid, if either of the two live; and as 560×73, ſo are the chances that the elder is dead, leaving the younger; and as 417×50, ſo are the chances that the younger is dead, leaving the elder; wherefore as 610×490 is to 560×73, ſo is the preſent value of a ſum to be paid at 8 years end, to the ſum to be paid for the chance of the younger's ſurvivance; and as 610×490 is to 417×50, ſo is the ſame preſent value to the ſum to be paid for the chance of the elder's ſurvivance: This poſſibly may be ſtill better explained by expounding theſe products by rectangular parallelograms as in Fig. 3. wherein A B or C D repreſents the number of perſons of the younger age, and D E, B H thoſe remaining alive after a certain term of years; whence C E will anſwer the number of thoſe dead in that time; ſo A C, B D may repreſent the number of the elder age, A F, B I the ſurvivors after the ſame term; and C F, D I thoſe of that age that are dead at that time; then the whole parallelogram A B C D will be Nn, or the product

duct of the two numbers of persons of the two given ages; and by what was said before, after the term proposed, the rectangle H D will be as the number of persons of the younger age that survive; and the rectangle A E as the number of those that die; so likewise the rectangles A I, F D will be as the numbers living and dead of the other age; hence the rectangle H I will be as an equal number of both ages surviving; the rectangle F E being the product of the deceased, or Y *y*, an equal number of both dead; the rectangle G D or R *y*, a number living of the younger age, and dead of the elder; and the rectangle A G or *r* Y a number living of the elder, but dead of the younger: This being understood, it is obvious, that as the whole rectangle A D or N *n* is to the gnomon F A B D E G or N *n* Y *y*, so is the whole number of persons or chances, to the number of chances that one of the two persons is living; and as A D, or N *n*, is to F E, or Y *y*, so are all the chances, to the chances that both are dead; whereby may be computed the value of the reversion after both lives; and as A D to G D or R *y*, so are the whole number of chances, to the chances that the younger is living, and the other dead; whereby may be compared, what value ought to be paid for the reversion of one life after another, as in the case of providing for clergymen's widows, and others by such reversions; and as A D is to A G, or *r* Y, so are all the chances, to those that the elder survives the younger.

Use seventh, if three lives are proposed, to find the value of an annuity, during the continuance of any of those three lives; the rule is, as the product of the continual multiplication of the three numbers in the table, answering to the ages proposed, is to the difference of that product, and of the product of the three numbers of the deceased of those ages, in any given term of years; so is the present value of a sum of money to be paid certainly after so many years, to the present value of the same sum to be paid, provided one of those three persons be living at the expiration of that term; which proportion being yearly repeated, the sum of all those present values will be the value of an annuity, granted for three such lives; but to explain this, together with all the cases of survivance in three lives; let N be the number in the table for the younger age, *n* for the second, and *v* for the elder; let Y be those dead of the younger in the term proposed, *y* those dead of the second age, and *v* those dead of the elder; and let R be the remainder of the younger age, *r* that of the middle age, and *s* the remainder of the elder; then will R + Y be = N, *r* + *y* = *n* and *s* + *v* = *v*; and the continual product of the three

three numbers $N n v$ will be equal to the continual product of $R + Y \times r + y \times \varrho + v$, which, being the whole number of chances for three lives, is compounded of the eight products following. 1. $R r \varrho$, which is the number of chances, that all the three persons are living. 2. $r \varrho Y$, which is the number of chances, that the two elder are living, and the younger dead. 3. $R \varrho y$, the number of chances that the middle age is dead, and the younger and elder living. 4. $R r v$, being the chances, that the two younger are living, and the elder dead. 5. $\varrho Y y$, the chances that the two younger are dead, and the elder living. 6. $r Y v$, the chances that the younger and elder are dead, and the middle age living. 7. $R y v$, the chances that the younger is living, and the two other dead. 8. $Y y v$, the chances that all three are dead; which latter substracted from the whole number of chances $N n v$, leaves $N n v - Y y v$, the sum of all the other seven products; in all of which, one or more of the three persons are surviving.

To make this still more evident, in Fig. 7. these eight several products are exhibited at one view: Let the rectangular parallelopiped ABCDEFGH be constituted of the sides AB, GH, &c. proportional to N the number of the younger age; AC, BD, &c. proportional to n; and AG, CE, &c. proportional to the number of the elder, or v; and the whole parallelopiped will be as the product $N n v$, or the whole number of chances: Let BP be as R, and AP as Y, let CL be as r, and Ln as y, and GN as ϱ, and NA as v; and let the plane PRea be made parallel to the plane ACGE; the plane NUbY parallel to ABCD; and the plane LXTQ parallel to the plane ABGH; and the first product $R r \varrho$ will be as the solid STW IFZeb; the second, or $r \varrho Y$ will be as the solid EYZeQS MI; the third, $R r y$, as the solid RHOUWIST; the fourth $R r v$, as the solid ZabDWXIK; the fifth $\varrho Y v$, as the solid GQRSIMNO; the sixth $r Y v$, as the solid IKL MGYZA; the seventh $R y v$, as the solid IKPOBXUW; and the eighth $Y y v$, the product of the three numbers of persons dead, as the solid AIKLMNOP: Now to shew in one case, how all the rest may be performed, let it be demanded, what is the value of the reversion of the younger life, after the two elder proposed? The proportion is, as the whole number of chances, or $N n v$, to the product $R y v$; so is the certain present value of the sum payable after any term proposed, to the value due to such chances, as the younger has to survive both the elder, by the term proposed, which therefore he is to pay for; here it

is to be noted, that the first term of all these proportions is the same throughout; *viz.* $N n v$, the second changing yearly according to the decrease of R, r, ϱ, and encrease of Y, y, υ; and the third are successively the present value of money payable after one, two, three, *&c.* years, according to the rate of interest agreed on; these numbers, being in all cases of necessary use, are put into the following table, and they are the decimal values of one pound payable after the number of years in the margin, at the rate of *6 per Cent.*

Years	Present value of 1 *l.*	Years	Present value of 1 *l.*	Years	Present value of 1 *l.*
1	0,9434	19	0,3305	37	0,1158
2	0,8900	20	0,3118	38	0,1092
3	0,8396	21	0,2941	39	0,1031
4	0,7921	22	0,2775	40	0,0972
5	0,7473	23	0,2618	45	0,0726
6	0,7050	24	0,2470	50	0,0543
7	0,6650	25	0,2330	55	0,0406
8	0,6274	26	0,2198	60	0,0303
9	0,5919	27	0,2074	65	0,0227
10	0,5584	28	0,1956	70	0,0169
11	0,5268	29	0,1845	75	0,0126
12	0,4970	30	0,1741	80	0,0094
13	0,4688	31	0,1643	85	0,0071
14	0,4423	32	0,1550	90	0,0053
15	0,4173	33	0,1462	95	0,0039
16	0,3936	34	0,1379	100	0,0029
17	0,3714	35	0,1301		
18	0,3503	36	0,1227		

It were needless to advertise that the great trouble of working so many proportions will be very much alleviated by using logarithms; and that instead of employing $N n v - Y y v$ for the second term of the proportion in finding the value of three lives, it may suffice to use only $Y y v$, and then deducting the fourth term so found out of the third, the remainder will be the present value sought; or all these fourth terms being added together, and deducted out of the value of the certain annuity for so many years, will leave the value of the contingent annuity upon the chance of mortality of all those three lives; for example, let there be 3 lives of 10, 30, and 40 years of age proposed, and the proportions will be thus:

As

As $661 \times 531 \times 445$, or 156190995, or $N\,nv$, to $8 \times 8 \times 9$, or 576, or $Y\,yv$, for the first year; so 0,9434, to 0,00000348.
to $15 \times 16 \times 18$, or 4320, for the 2d year; so 0,8900, to 0,00002462
to $21 \times 24 \times 28$, or 14112, for the 3d year; so 0,8396, to 3,00008128
to $27 \times 32 \times 38$, for the 4th year; so 0,7921, to 0,00016650
to $33 \times 41 \times 48$, for the 5th year; so 0,7473, to 0,00031071
to $39 \times 50 \times 58$, for the 6th year; so 0,7050, to 0,00051051

And so on to the 60th year, when we suppose the elder life of forty certainly to be expired; from whence till 70 we must compute for the first and second only, and from thence to 90 for the single youngest life; then the sum total of all these fourth proportionals being taken out of the value of a certain annuity for 90 years, being 16,58 year's purchase, will leave the just value to be paid for an annuity, during the whole term of the lives of 3 persons of the ages proposed; and note, that it will not be necessary to compute for every year singly, but that in most cases every 4th or 5th year may suffice, interpolating for the intermediate years.

It may be objected, that the different salubrity of places does hinder this proposal from being universal, which must be allowed; but by the number that die, being 1174 *per annum* in 34000, it appears that about a 30th part die yearly, as Sir *William Petty* hath computed for *London*; and the number that die in infancy is a good argument, that the air is but indifferently wholesome; so that as far as appears, there cannot be a better place than *Breslaw* proposed for a standard.

To examine the freshness of Water; *by Mr.* Boyle. Phil. Trans. N° 197. p. 627.

THE honourable Mr. *Boyle* having found by various trials, that several metallic and other mineral solutions could be readily precipitated, not only by the spirit of salt, but by crude salt, whether dry or dissolved in water, it was no very difficult matter for him to think, that, by a heedful application of the precipitating quality of common salt, one might discover, whether any particles of it, at least in any considerable number, lay concealed in distilled water, or any other proposed to be examined: He took some common water distilled in glass-vessels, that it might leave its salt, if it had any, behind it, and he put one grain of common dry salt into a thousand grains of it; into a convenient quantity, as two or three spoonfuls, of this impregnated liquor, he let fall a fit proportion, for instance 4 or 5 drops, of a very strong and well filtrated solution of refined silver, dissolved in clear *Aqua-fortis*; upon which there immediately

appeared a whitiſh cloud, which, tho' but ſlowly, deſcended to the bottom, and ſettled there in a white precipitate: The uſefulneſs of this experiment is not to be eſtimated only by the *Examen*, it helps us to make of dulcified water, but much more by the eſtimate, that by its means may be made of natural freſh waters, whether of ſprings, rivers, clouds, lakes, wells, &c. for it being generally granted, that thoſe waters, *cæteris paribus*, are the beſt, as well for their wholeſomeneſs, as for ſeveral oeconomical uſes, as waſhing, brewing, &c. that are freeſt of ſaltneſs, which is an adventitious, and in moſt caſes, a hurtful quality in waters; by this way of examining theſe liquors, an attentive eye may ſoon diſcover, whether there be any latent ſaltneſs in them, and one may be enabled, eſpecially by a little practice, to give a near gueſs, how much one water is freſher than another; and after once obſerving, what change four or five drops of the precipitant will make in two or three, or any other number of ſpoonfuls of water, it will not be difficult to make a near eſtimate, whether any natural water propoſed to him, have a greater, an equal, or a leſſer degree of freſhneſs or ſaltneſs, than the water choſen for the ſtandard; and how much the propoſed liquor is more or leſs free from ſaltneſs than the other; and that ſuch a difference in water may have conſiderable effects upon human bodies in regard of health, may be probably argued from the different effects, that waters more or leſs impregnated with ſalt, have upon ſeveral other bodies; ſince moſt pump-water, for inſtance, will not boil peaſe and beef, and ſome other things, near ſo well as ſpring or rain-water, which are uſually ſofter, and freer of ſaltneſs; it is commonly known, that the ſame pump-water will not ſo well and uniformly diſſolve waſh-balls and ſoap, as rain-water, and ſome running-waters uſually will; and ſkilful artiſts obſerve, that ſome tools, as gravers, &c. would receive a different temper, if they were quenched in pump-water, from that, which the like extinction in ſpring-water or river-water would give them: But here it may be objected, that the trial was made upon water impregnated with groſs or corporeal ſea-ſalt, which hinders not, but that it may be embued with the ſpirits of marine ſalt, which by reaſon of their activity, may be as unhealthful to the drinker, as the groſſer ſalt itſelf; but tho', to this ſurmiſe it muſt be anſwered, that a very ſmall proportion of ſpirit of ſalt, might in many caſes make the water ſeaſoned therewith, rather medicinal than unwholeſome; yet as a more direct anſwer, Mr. *Boyle* took above a thouſand grains of diſtilled water, and inſtead of groſs ſalt, he put to them one ſingle drop of moderately ſtrong

ſtrong ſpirit of ſalt, and ſhaking it in the water, he let fall, into a portion of this unequally compoſed mixture, ſome drops of his ſolution of ſilver, which preſently began to precipitate in a whitiſh form, and this trial ſucceeded better than if the water had been impregnated with but a 1000th part of groſs ſalt; and to purſue this trial farther, one drop of ſpirit of ſalt was diffuſed into 2000 grains of diſtilled rain-water, and upon letting fall ſome drops of his precipitant into it, the ſucceſs anſwered expectation; and as a farther trial, one grain of ſpirit of ſalt had a manifeſt operation, tho' not quite ſo conſpicuous as the former, on above 3000 grains of water, whoſe immunity from common ſalt was tried a-part; and that a drop of the ſaline ſpirit, that was uſed, did not equal in weight a grain of dry ſalt, was thus found; upon letting fall into a counterpoiſed piece of glaſs ten drops of that ſpirit, they wanted near half a grain of the weight of nine grains; the like trial was made, by ſubſtituting above 1000 grains of rain-water inſtead of the like quantity of diſtilled water.

Dr. *Hook* could diſcover the ſmalleſt quantity of ſalt contained in water, by means of a large poiſe of glaſs, ſomewhat of the ſhape of a bolt-head, whoſe ball B, Fig. 8. Plate II. was about three inches diameter, but the ſtem, or neck thereof, C C was not above $\frac{1}{24}$ of an inch; this was ſo poiſed by red lead put into it, as to make it but a little heavier than fair or freſh water; then this poiſe was ſuſpended by the ſmall ſtem to the end of a ſlender beam A, which was very tender, and would turn with a ſmall part of a grain; this beam was hung on a ſteady frame, and the poiſe hanging at one end of the ſame, covered with the water to a certain mark, or diviſion, made on the ſmall neck at D, it was ſo counterpoiſed by ſome ſmall weights put into the oppoſite ſcale of the balance F; then the weight of the water contained in the ciſtern, or veſſel E E, into which the poiſe was immerſed, being firſt known, a 2000th part of its weight was taken of common ſalt, weighed out, and put into the whole 2000 parts of water, which, by being ſtirred, were diſſolved; and the poiſe being ſuſpended as before, near half an inch of the neck did emerge out of the water, more than did before the 2000th part of ſalt was diſſolved therein.

Three Queries relating to Shells; *propoſed by Mr.* Sam. Dale, *and anſwered by Dr.* Liſter. Phil. Tranſ. N° 197. p. 641.

1. WHAT are the *Entalia* of the ſhops, by what authors deſcribed, under what name, and how they differ from the *Dentalia?*

2. Of

2. Of what ſhell is the *Blatta Byzantina* the *Operculum* or lid?

3. Of the ſeveral ſorts of *Purpuræ* amongſt authors, which is that of the ſhops? Likewiſe which ſort of *Buccina* and *Umbilici marini* ought to be uſed in the ſhops?

1. As to the *Entalia*, Dr. *Liſter* does not remember to have ſeen any thing in the ſhops under that name: The deſcriptions of the *Dentalia* in *Schroder* are very faulty, and both theſe and the *Entalia* ſhould ſeem by him to be the two ſpecies of *Dentalia*, which are figured by Dr. *Liſter*; the *Dentalium* being that, which is commonly, and in great plenty, found about the iſland of *Guernſey*, and elſewhere on our coaſt, and the ſame with that found in the *Mediterranean:* It is a long, ſlender, round pipe, a little bending and tapering, hollow and open at both ends, without any crack or flaw, naturally white at one extremity, and uſually a little reddiſh; it is very ſmooth, and poliſhed on the outſide, and from thence, and its figure, called a *Dog-like-tooth:* The *Entalium*, or other ſpecies of the *Dentalia*, is much longer and thicker than the former, but much alike in other reſpects, ſave that this is ſtreaked with high ridges, and moſtly of a greeniſh colour: This ſpecies, Dr. *Liſter* conjectures, came from the *Indies*; *Note*, that any thing, that is wrought into, or channeled, is by the *Italians* called an *Intaglia*; whence, and from the affinity of the word *Dentalia*, he ſuppoſes thoſe diſtinctions of names had their riſe.

2. To the ſecond query; Dr. *Liſter* takes the *Blatta Byzantina* to have ſucceeded the *Unguis odoratus*, and to have been introduced into the ſhops in its ſtead; in *Dioſcorides*'s time, the beſt was brought from the *Red Sea*, *viz.* the paleſt and fatteſt; the blacker and ſmaller, from *Babylon*, or the *Perſian* gulf; but it ſeems, later times took up with thoſe found about *Conſtantinople*, whence the preſent ſhop *Blatta* had its name; and it was called *Blatta*, probably from its dark hair colour; it is true, *Dioſcorides* ſays, that the *Unguis* was an *Operculum*, like that of the purple fiſh; he means what was uſed in his time, when it ſeems the *Unguis odoratus* was loſt, or was not brought to *Europe*; but it will appear from the ſame *Dioſcorides*, that the *Unguis* was no *Operculum*; and it will be worth the while to ſhew this miſtake, and conſequently the errors of the Moderns in ſubſtituting the *Operculum* of a marine *Turben*, for the true *Unguis odoratus:* The *Unguis odoratus*, according to *Dioſcorides*, is found in the lakes of *India*, where *Nard* doth grow; wherefore the *Conchylia* feeding on *Nard* are aromatick; it is gathered after the lakes have been

been dried up with ſummer-heats; and he concludes, that the *Conchylium* it ſelf, burned or calcined, is of the ſame efficacy with the *Purpura* and *Buccinum* burnt: In the chapter of *Nard*, he farther ſays, that the *Indian Nard* grew near the river *Ganges*, that is, in certain lakes, cauſed by overflowing of that river: Hence, it appears firſt, that the *Unguis odoratus* was part of a freſh water *Conchylicum*. 2. If it was generated in the nardiferous lakes upon the river *Ganges*, how comes it that the ſame was brought from the *Red-Sea* and *Babylon?* And why ſhould the ſhell it ſelf be brought ſo far as from the river *Ganges* to *Greece*, ſince the *Operculum* was rarely a tenth part of the ſhell it ſelf? Dr. *Liſter* does therefore conjecture, that the true *Unguis odoratus* was ſomething like the half of a *Pectunculus Fluviatilis*, ſo common in the river *Thames*, of the largeneſs and bigneſs of a thumb-nail; and that for theſe reaſons. 1. That the *Unguis odoratus* ſeems to have been a freſh water bivalve or muſcle, becauſe it was not gathered 'till the lakes on the river *Ganges* were dried up; now bivalves are buried in the ſand and mud, and never riſe and ſwim about or float as the turbinate ſnails do, to which latter only the *Operculum* belongs, and which therefore were at all times and eaſily to be caught. 2. *Dioſcorides* calls this ſnail *Conchylium*, and by that general name he diſtinguiſhes it from all the other ſorts, concerning which he treats in ſeveral chapters; which tho' in general it takes in both kinds, as well turbinate as bivalve, yet it does more particularly denote a *Concha* or bivalve. 3. The *Onyx* is expreſſly reckoned by *Pliny* amongſt the bivalves; for *l.* 32. *c.* 11. the following denominations are ſynonimous, *viz. Solen*, *Aulos*, *Donax*, *Onyx*, *five Dactylus*; and again more particularly, *l.* 9, *c.* 61. he ſays that the *Dactyli* are of the bivalve kind, and ſo denominated from their reſemblance to the nails of the fingers; ſo that in all probability the *Onyx odoratus* anciently brought out of the freſh-water lakes about *Ganges* in *India*, was not unlike the common *Onyx* of the *Mediterranean*, which was of the *Solen* kind: Whatever the *Blatta Byzantina* of the ſhops be, it hath certainly nothing of the characters of the ancient aromatick *Unguis*, which in all probability was loſt, on account of the difficult paſſage from the *Ganges* into *Europe*; Dr. *Liſter* is of opinion, that it was a good medicine, from its ſtrong aromatic ſmell, which is much wanting in our teſtaceous powders.

To the third, the *Purpura* of the ancients is well made out and figured by *Fabius Columna*; and it is one of the moſt common *Murices* of the *Mediterranean*; in this he could not be much miſtaken,

taken, becauſe he ſomewhere mentions heaps of thoſe ſhells, where the *Officinæ Purpuræ* anciently were, and alſo from the purple *Sanies* the fiſh yields of itſelf; he mentions one or two more ſpecies of turbinate ſnails, to be found in the *Mediterranean*, which yield a purple juice. Upon the whole, it is indifferent, what ſort of ſhell we uſe in the ſhops, if it be to be calcined, providing it be a ſea-ſhell; and neither does *Dioſcorides* or *Ætius* diſtinguiſh betwixt the *Oſtrea Purpura*, or *Buccinum* calcined, but they aſcribe to them all the ſame cauſtic virtue; poſſibly ſome one ſpecies may have it in a higher degree; as the various ſorts of lime-ſtone, if calcined, differ in ſtrength. Tho' the ſpecies of ſhell or *Purpura* be ſcarcely known to our ſhops at this day, yet the uſe of the purple juice hath been by tradition at leaſt handed down to our times, and kept as a ſecret, till it was diſcovered and publiſhed by Mr. *Cole*; and from a paſſage of *Beda*'s eccleſiaſtical hiſtory, *l.* 1. *c.* 1. it appears that the purple trade of dying was uſed in *England*, and very much valued.

The Expanſion and Contraction of Fluids *by* Heat *and* Cold, *in order to aſcertain the Diviſions of the* Thermometer; *by Mr.* Edm. Halley. Phil. Tranſ. N° 197. p. 650.

QUalities, as heat and cold, moiſture and dryneſs, *&c.* are not otherwiſe to be eſtimated, but by their effects, as by encreaſing or leſſening the dimenſions of any body they act on, or elſe by the motions they produce; both which ſubject them to menſuration; but it is ſtill a queſtion how to aſcertain the proportional heat or cold, *&c.* that is between any two climates or ſeaſons, ſo as to conclude the one, for inſtance, twice as hot, or twice as cold as the other, tho' the inſtruments now in uſe abundantly ſuffice to ſhew, when the temper of the air is the ſame, and when it is warmer or colder; the reaſon is, that we know not the cauſes of the expanſion of fluids by heat, or of their contraction by cold, as ariſing from the nature of their conſtituent parts, which are ſo far from being objects of our ſenſes, that they even ſurpaſs our moſt refined reaſoning; for the ſame degree of heat does not proportionally expand all fluids; ſome ſwelling with a gentle warmth, and others not till they are conſiderably hot; ſome boiling with a moderate heat, and others not at all; ſome capable of a great expanſion, others of very little; ſo that it may well be concluded, that not one of them encreaſes or diminiſhes in the ſame ratio with the heat, and conſequently, that the thermometers graduated by equal parts of the expanſion of any fluid, are not ſufficient ſtandards of heat or cold: This will be more

more evident from experiments made in the months of *February* and *March*, (when the weather was reasonably cold, and not freezing) with water, mercury, and spirit of wine; wherein the following particulars were very remarkable. 1. Mr. *Halley* took a large bolt-head, holding about 3 ½ *lib.* of water, with a narrow neck, to make the increase thereof more sensible; and having filled it with water, he noted exactly to what mark the water rose; then he immersed it into a skillet of warm water, and let it stand so long, till he concluded the warm water had communicated its temper to the water included in the bolt-head; and he found, that tho' the water was warm, much beyond the degree of the summer's heat, and notwithstanding it was winter, yet that gentle heat had scarcely any effect in dilating the water, so that it appeared to have ascended in the neck of the bolt-head; then he took the skillet, and set it over the fire; when it was observable, that the water, as it grew hot, did slowly ascend in the neck, especially at first; but after it began to boil in the skillet, the expansion thereof became more visible, and it ascended a-pace, till such time as it stopped again, the utmost effort of boiling water being able to raise it no higher; then having made a mark at the greatest height, he took it out, and he observed, that tho' it was not raised so high without a very strong boiling, yet it subsided very slowly, as retaining for some time the space it had acquired from the heat, even after that heat was over, and the glass so cool, as to be touched without burning the fingers; however, next morning he found it reduced to the first mark, where it stood when at first put in, having lost nothing visibly by evaporation, during the experiment, which might be owing to the length of the neck, wherein the vapours were condensed into drops, before they reached the top; then he examined how much water would raise that in the neck, to the mark to which it had been dilated by boiling, and he found it was a 26th part of the bulk of the first water; which, upon repeated experiments, he observ'd to be true; but it was obvious, that water dilating so very little, with all the degrees of heat the air receives from the sun, was a very improper fluid to make a thermometer withal; and besides, any freezing liquor is useless for this purpose in these northern climates. 2. He took a smaller bolt-head, with a proportionable tube or neck, and filled it after the same manner with mercury, and having boiled it as above, he observed, that 125 ounces of mercury had occupied as much space as 810 grains, or a 74th part of its bulk when cold; but it was very remarkable, that whereas a gentle heat had scarce any effect on water, here on the contrary,

the mercury did ſenſibly aſcend at firſt, and had almoſt attained its greateſt expanſion, before the water boiled in the ſkillet; and after it had boiled, tho' it ſtood long over the fire, he could not diſcern that the moſt vehement boiling had any effect on it, above what appeared, when it firſt began to boil; the mercury being taken out, ſubſided as it cooled, and in a few hours returned to the mark, at which it ſtood before it was put into the water; this fluid, being ſo ſenſible of a gentle warmth, and withal not ſubject to evaporate without a great degree of fire, might moſt properly be applied to the conſtruction of thermometers, were its expanſion more conſiderable: However, ſmall as it is, it is ſufficient to diſturb the preciſe nicety of the mercurial barometers, ſhewing the counterpoiſe of the preſſure of the atmoſphere by a cylinder of mercury; for if mercury be more expanded, and conſequently lighter in warm weather than in cold, it will neceſſarily follow, that the ſame weight of the atmoſphere will require a taller cylinder in ſummer, and a ſhorter in winter to counterpoiſe it; and if the extremity of weather doth but occaſion 150th part difference, as is probable it doth, the effect thereof on a barometer will be the 10th of an inch, above and below the mean, or a 5th in the whole. 3. The ſmaller bolt-head was filled with ſpirits of wine, and having ſet it in the ſkillet of water over the fire, it was found to aſcend gradually as the heat encreaſed, but ſlower at firſt, and faſter after it was well warmed; at length, being arrived at a certain degree of heat, it would then boil with great violence, emitting bubbles, which, riſing in the neck of the bolt-head, would elevate all the incumbent ſpirits, till they had made their way thro'; and theſe ſucceeding each other very faſt, would often raiſe the ſpirits to the top of the neck, and cauſe it to run over; ſo that there was no farther proceeding with this fluid than to that degree of heat, which cauſed this boiling, and which was very much ſhort of that of boiling water, being almoſt tolerable to the touch: It was however very remarkable, how exactly this degree of heat was determined by the expanſion of the ſpirits; for immediately, as it reached a certain mark on the neck, it began to emit bubbles, and being taken out a little to cool, and ſubſide, it would certainly and conſtantly fall a bubbling again, when upon a ſecond immerſion, it was arrived at the aforeſaid mark; during this experiment, it appeared both by the dew on the neck, and by the ſcent in the room, that tho' the neck were about 30 inches long, yet the ſpirits did evaporate very faſt, conſidering the ſmallneſs of the ſurface of the liquor: This degree of heat, which made ſpirits of wine begin to boil, being determined ſo nicely,

made

made Mr. *Halley* conclude, that this might very properly be taken for the limits of the scale of heat in a thermometer; and the effect thereof in the expansion of any other fluid being accurately noted, might be easily transferred to any sort of thermometer whatever; only it must be observed, that the spirits of wine, used to this purpose, be highly rectified or dephlegmated, for otherwise the different goodness of the spirits will cause them to boil sooner or later, and thereby pervert the designed exactness: And by the bye it may be hinted, that the boiling of spirits sooner or later, may possibly be as good a test of their strength and perfection as their specific gravity, or any other method yet used: The spirits of wine, Mr. *Halley* made use of, were possibly none of the best, but he observed, that at the point of boiling, they had encreased a 12th part in bulk; which great dilatation makes it a liquor sufficiently adapted to our purpose, were it not for its evaporation; for the difference of the goodness of the spirits, and because that by length of time they become effœte, and lose gradually a part of their expansive power. 4. Several other liquors may be examined after this manner, but these alledged may suffice to shew the different effects of heat on different fluids; and that this power of dilating and contracting with heat and cold, is as specifically in them as their gravity, rarefaction, *&c.* but in none so conspicuous, as in that rare elastic fluid the air; for by several experiments, Mr. *Halley* found that the heat of summer does expand the ordinary air about a 30th part; and the honourable Mr. *Boyle*, in his history of cold, *Tit.* 18. §. 8. *p.* 475. alledges experiments, which prove that the force of the strongest cold in *England*, does not contract the air above $\frac{1}{20}$ part; so that the same air, which, in extreme cold occupies 12 parts of space, in very hot summer weather, will require 13 such spaces; which is as great an expansion as that of spirits of wine, when they begin to boil; for which reason, and because it is so sensible of heat and cold, and because it continues to exert the same elastic power, after being ever so long included, it is the propereſt fluid for the purpose of thermometers: Now the thermometers hitherto in use, are of two sorts; the one shewing the different temper of heat and cold by the expansion of spirits of wine, the other by the air; but neither of them was ever so well made or adjusted, as that it might be concluded, what the degrees or divisions of the said instruments did mean; neither were they ever otherwise graduated, but by standards kept by each particular workman, without any agreement with, or reference to each other; so that whatever observations any curious person may make by his thermometer,

to signify the degree of heat in the air, cannot be understood, unless by those, who have thermometers of the same make and adjustment; much less has the way been shewn how to make this instrument without a standard, or to make two of them agree artificially, without comparing them together: To this Mr. *Halley* subjoins, that whereas the usual thermometers with spirits of wine, do some of them begin their degrees from a point, which is that at which the spirits stand, when it is so cold as to freeze oil of aniseed; and others again, from the point of beginning to freeze water; Mr. *Halley* conceives those points not to be so justly determinable, but with a considerable latitude; and that the just beginning of the degrees of heat and cold should not be from such a point as freezes, but rather from temperature, such as is in places of considerable depth under ground; where the heat of the summer, or cold of winter, have, by the experiment of M. *Mariotte*, in the grotto's under the observatory at *Paris*, been found to have no manner of effect.

Some farther Considerations on the Breslaw Bills *of* Mortality; *by Mr.* Edm. Halley. Phil. Trans. N° 198. p. 654.

MR. *Halley* endeavoured to find out a theorem, that might be more concise than the rules laid down N° 196. p. 596. for computing the value of two, three, or more lives, but all in vain; for all that can be done to expedite it, is by tables of logarithms ready computed, to exhibit the ratio's of N to Y in each single life, for every third, fourth, or fifth year of age, as occasion shall require; and these logarithms being added to those of the present value of money payable after so many years, will give a series of numbers, the sum of which will shew the value of the annuity sought; however, for each number of this series, two logarithms for a single life, three for two lives, and four for three lives must necessarily be added together.

It may not perhaps be unacceptable to infer from the tables, N° 196. how unjustly we repine at the shortness of our lives, and think ourselves injured, if we attain not to old age; whereas hereby it appears, that the one half of those that are born, are dead in seventeen years time, 1238 being in that time reduced to 616; so that instead of murmuring at what we call an untimely death, we ought to account it, as a blessing that we have survived, perhaps by many years, that period of life, at which the one half of the whole race of mankind doth not arrive: A second observation is, that the growth and encrease of mankind is not so much stinted by

by any thing in the nature of the ſpecies, as it is from the cautious difficulty moſt people make to adventure on the ſtate of marriage, from the proſpect of the trouble and charge of providing for a family; nor are the poorer ſort of people herein to be blamed, ſince their difficulty of ſubſiſting is occaſioned by the unequal diſtribution of poſſeſſions, all being neceſſarily fed from the earth, of which yet ſo few are maſters; ſo that beſides themſelves and families, they are yet to work for thoſe, who are owners of the ground that feeds them; and of ſuch, does by far the greater part of mankind conſiſt; otherwiſe it is plain, there might well be four times as many births as we now find; for by computation from the table, there are found 15000 perſons above 16 and under 45, of which, at leaſt 7000 are women capable of bearing children; of theſe notwithſtanding, there are but 1238 born yearly, which is but little more than a ſixth part; ſo that about one in ſix of theſe women do breed yearly; whereas were they all married, it would not appear ſtrange or unlikely, that four of ſix ſhould bring forth a child every year; the political conſequences of this are evident; the ſtrength and glory of a king conſiſt in the multitude of his ſubjects, therefore above all things celibacy ought to be diſcouraged, as by extraordinary taxing and military ſervice; and thoſe who have numerous families of children ſhould be countenanced and encouraged by ſuch laws, as the *Jus trium Liberorum* amongſt the *Romans*; but eſpecially by an effectual care to provide for the ſubſiſtence of the poor, by finding them employment, whereby they may earn their bread, without being chargeable to the publick.

Pearl Fiſhing *in* Ireland; *by Sir* Rob. Redding, Phil. Tranſ. N° 198. p. 659.

IN the county of *Tyrone* there are four rivers, abounding in that ſort of muſcles, in which pearls are found, all emptying themſelves into *Lough Foyle*, on which the town of *Derry* ſtands, and then into the ſea; there are alſo other rivers in the county of *Donnegal*, and a river near *Dundalk*, likewiſe the *Shure* running by *Waterford*, and the *Lough* called *Lough Lean* in *Kerry*, which affords the like fiſh: There is nothing extraordinary in the manner of fiſhing there; in the warm months before harveſt, whilſt the rivers are low and clear, the poor people go into the water, and ſome take them up with their toes, others with wooden tongs, and others again by putting a ſharpened ſtick into the opening of the ſhell; and altho' by common eſtimate, not above one ſhell in a hundred may have a pearl, and of theſe pearls not above

above one in a hundred are tolerably clear, yet a vaſt number of fair merchantable pearls are every year ſold by thoſe people; and Sir *Robert* himſelf ſaw a pearl that weighed 36 carats, and was valued at 40*l.* the young muſcles are never obſerved to have any pearl in them; the ſhell is faſtened with two tendons, one at each end, whereas the oyſter and ſcallop have only one in the middle; they lie in part open, putting forth their white fins, like a tongue, by which the eye is directed to them, being otherwiſe as black as the ſtones in the river; the backs of the ſhells both in young and old, juſt about the hinges, on which the valves open, are all broken and bruiſed, and ſhew the ſeveral cruſts and ſcales that make up the ſhell, which is probably cauſed by the rolling of large ſtones over them in great floods; the inſides of the ſhell are of an oriental and pearl-colour and ſubſtance, like a flat pearl, eſpecially when firſt opened; and there is obſerved in ſome ſhells under the firſt coat a liquor very orient and clear, that moves upon preſſure by the finger, but ſuch a muſcle never has a pearl; and probably this liquor is the true mother of pearl: The pearl lies in the ſmaller extremity, at the end of the gut, and out of the body of the fiſh, between the two films or ſkins that line the ſhell; it is probable that the pearl anſwereth to the ſtone in other animals, and it is certain that in the ſame manner it encreaſes by ſeveral cruſts growing over each other, which appears by pinching the pearl in a vice; for the upper coat will crack and fly away, and this ſtone is caſt out and voided by the muſcle; for many ſhells that have had pearls in them, are afterwards found to have none; the ſhells that have the beſt pearls are wrinkled, twiſted or bunched, and not ſmooth and equal as thoſe that have none; it is thought, that theſe pearls, if once dark, will never become clear upon any alteration in the health or age of the muſcle; and that if the ſeed be black, all the coats ſuperinduced will be ſtill clouded.

An Accounnt of digging and preparing the Lapis Calaminaris; *by Mr.* Giles Pooley. Phil. Tranſ. N° 198. p. 672.

THE *Lapis Calaminaris*, or *Calamine*, is dug and prepared near *Wrington* in *Somerſetſhire*; the groovers have no certain rule to direct them in finding it out, either from the ſurface of the earth, or the nature of the ground; it being ſometimes found in meadows, ſometimes in arable, and ſometimes again in paſture grounds, and very commonly in barren and rocky ground; nor is it diſcoverable from the colour or taſte of the water, as being much of the ſame colour, taſte, clearneſs and wholſomneſs

ſomneſs with other water, nor from the withering of the graſs on the ſurface of the earth, or of the leaves on the trees, which are as freſh where *Calamine* lies, as in any other place; but it is obſervable that the groovers always dig for it upon, or near the hills; for they expect none in thoſe grounds, which have no communication with hills.

Their method for finding out a vein, is to dig a trench as deep as the rocks, where they expect it to lie, acroſs the place where they look for a courſe; which trench they generally dig from north to ſouth, or near upon that point, the courſes uſually lying from eaſt to weſt, or at ſix o'clock, as their term is, tho' this does not always hold; for ſometimes the courſes, ſeams or rakes, as they call them, lie at nine o'clock, and they are ſometimes perpendicular, which they call the high time of the day, or twelve o'clock, and theſe courſes they eſteem the beſt; theſe ſeams or courſes run between the rocks generally wider than thoſe of lead ore, unleſs they are incloſed in very hard cliffs, and then they are as narrow as the veins of lead; the colour of the earth, where *Calamine* lies, is generally a yellow grit, but ſometimes it is black; for all countries, as they term their under-ground works, are not alike: *Calamine* itſelf is of ſeveral colours; ſome white, ſome reddiſh, ſome greyiſh, and ſome blackiſh, which is counted the beſt; but when this latter is broken, it is alſo of ſeveral colours: In working for it below in the countries, they uſe the ſame method and inſtruments, as they do in lead-mines; and ſometimes they light on a good quantity of lead, but they always find ſome eyes of lead amongſt the *Calamine*, which, in ordering of it, they ſeparate; tho' in lead-mines they do not always find *Calamine:* In landing of the *Calamine*, ſome pieces are bigger than others, and of different ſizes as other ſtones are, and mixt with a gritty earth; but generally it riſes in ſmall particles, ſome bigger, ſome ſmaller, and ſome about the bigneſs of a nut, and this they call a ſmall *Calamine:* In ancient works, which are thoſe that have been forſaken and afterwards wrought again, damps and ſtenches frequently ariſe, but never in new works; and theſe damps are owing to the workmen, who do not take care to convey air along with them, which is done by air-ſhafts, as in lead-mines.

When they have landed a good quantity of this *Calamine*, which is done by winding it up in buckets from their works, they carry it away to the places, where they waſh, clean or buddle it, as their term is, which they perform in this manner; they incloſe a ſmall piece of ground with boards or turf, thro' which a clear

ſtream

ſtream of water runs; within this incloſure they ſhovel their *Calamine* with the reſt of the impure and earthy parts, and theſe parts are carried away at the one end of the incloſure by the running water, which comes in at the other, and the lead, the *Calamine*, and the other heavier, ſtony, and ſparry parts are left behind; and in order the better to cleanſe and buddle the *Calamine*, whilſt it is in this incloſure, they often turn it, that ſo the water paſſing thro', may waſh it the better; when they have thus waſhed it as clean as they can, after raking up the bigger parts both of the lead and *Calamine*, they afterwards put the ſmaller parts, that they may loſe none of their ore, into ſieves made of ſtrong wire at the bottom; and theſe ſieves, with the *Calamine*, lead, and the remainder of the earthy, ſparry and ſtony parts, which the water could not waſh away, they often dip and ſhake up and down in a great tub of water; and by this ſhaking, the parts of the lead mixt with the *Calamine* ſink or pitch down to the bottom of the ſieves, as being heavieſt; the parts of the *Calamine* remain in the middle, and the other ſparry, ſtony and traſhy parts riſe up to the top; which as they riſe, they ſkin off, and throw them amongſt the reſt of the rubbiſh; and then they take off the *Calamine*, and after that the lead: When they have thus cleanſed the *Calamine*, as well as they can, in order to cleanſe it ſtill farther, they are forced to ſpread it on a board, and ſo pick out the traſh and ſtones that remain; but all of it does not require ſo much trouble; for ſome riſes big enough out of the works to be cleanſed and picked fit for the calcining oven, without all this charge and pains; and there are ſeveral loads of this great *Calamine*, which have no mixture of earth or traſh.

After they have prepared their *Calamine* by waſhing and picking it, they then carry it to the oven, which is larger than a baker's oven, but made much in the ſame faſhion; only the way of heating, burning, or baking the *Calamine* is different; for it is not done in the ſame manner as bread; but they caſt in their coals into a hearth made on one ſide of the oven, which is divided from the oven itſelf by a hem or partition, made open at the top, whereby the flame of the fire paſſes over, and ſo heats and bakes the *Calamine*; they let it lie in the oven for the ſpace of four or five hours, the fire burning all the while, according to the ſtrength of the *Calamine*; ſome being much ſtronger than other ſome, and ſo requiring a longer time; and whilſt it continues in the oven, they turn it ſeveral times with long iron coal-rakes; and when it is ſufficiently burnt, baked and dried, they beat it to a powder

a powder with long iron hammers, like mallets, on a thick plank, picking out what ſtones they find amongſt it; ſo that at laſt the *Calamine* is reduced to duſt, and then it is fit for the merchant: The duſt of *Calamine* conduces much to the curing of ſore eyes, and it is frequently uſed for taking films off the eyes of horſes and other beaſts.

The ſpecific Gravities of ſeveral Bodies. Phil. Tranſ. N° 199. p. 694.

PUMP-water	1000
Cork	237
Saſſafras wood	482
Juniper wood (dry)	556
Plum-tree (dry)	663
Maſtic	849
Santalum Citrinum	809
——— *album*	1041
——— *rubrum*	1128
Ebony	1177
Lignum Rhodium	1125
——— *Aſphaltum*	1179
Aloes	1177
Succinum Pellucidum	1065
——— *Pingue*	1087
Jet	1238
The top part of a rhinoceros's horn	1242
The top part of an ox's horn	1840
The blade-bone of an ox	1656
A human *Calculus*	1240
Another human *Calculus*	1433
Another *Calculus*	1664
Brimſtone, ſuch as is commonly ſold	1311
Borax	1720
A ſpotted factitious marble	1822
A galley-pot	1928
Oyſter-ſhell	2092
Murex-ſhell	2590
Lapis Manati	2270
Selenitis	2322
Wood petrified in *Lough Neagh*	2341
Onyx-ſtone	2510
Turcois-ſtone	2508
Engliſh agat	2512

Grammatias Lapis	2515
A *Cornelian*	2568
Corallachates	2605
Talc	2657
Coral	2689
Hyacinth (ſpurious)	2631
Jaſper (ſpurious)	2666
A pellucid pebble	2641
Rock cryſtal	2659
Cryſtallum Disdiaclaſticum or *Iceland* cryſtal	2704
A red paſte	2842
Lapis Nephriticus	2894
—— *Amianthus* from *Wales*	2913
—— *Lazuli*	3054
A hone	3288
Sardachates	3598
A granat	3978
A golden marcaſite	4589
A blue ſlate with ſhining particles	3500
A mineral ſtone, yielding 1 part in 160 of metal	2650
The metal thence extracted	8500
The (reputed) ſilver ore of *Wales*	7464
The metal thence extracted	11087
Biſmuth	9859
Spelter	7065
Spelter ſolder	8362
Iron of a key	7643
Steel	7852
Caſt braſs	8100
Wrought braſs	8280
Hammered braſs	8349
A falſe guinea	9075
A true guinea	18888
Sterling ſilver	10535
A braſs half crown	9468
Electrum, a *Britiſh* coin	12071
A gold coin of *Barbary*	17548
A gold medal from *Morocco*	18420
A *Mentz* gold ducat	18261
A gold coin of *Alexander*'s	18893
A gold medal of Q. *Mary*	19100
—— *Elizabeth*	19125
A medal eſteemed to be nearly fine gold	19636

The

The Iron-Works *in* Lancaſhire; *by Mr.* John Sturdy. Phil. Tranſ. N° 199. p. 695.

AT *Milthorp-forge* in *Lancaſhire*, they have ſeveral ſorts of iron-ſtone of different natures; for ſome make *Coldſhire* iron, that is, ſuch as is brittle, when cold; another ſort makes *Redſhire*, that is, ſuch as is apt to break, if it be hammered, when of a dark red heat, and therefore is never melted down but in mixture, and ſo it yields an indifferent ſort of iron; but it was much improved, by melting the ſow-metal over again, as likewiſe by uſing turf and charcoal; whereas formerly their only fuel was charcoal; they once made trial of pit-coal, but with bad ſucceſs; the ſmall duſty part of their charcoal is uſeful for burning the iron-ſtone; for every 17 baſkets of this burnt ſtone, they put one of lime-ſtone unburnt, to make it melt freely, and caſt the cinder, which they always take off from the melted iron with a coal-rake at a hole in the furnace-mouth, before they let the metal run; nothing remains in the bottom of the hearth, all becoming either iron or cinder: The furnace is built on the ſide of a hill, the bottom is about two yards ſquare, and ſo riſes perpendicular for a yard or more; it is alſo lined within with a wall of the beſt fire-ſtone to keep off the force of the fires from the walls of the furnace; the bellows, which are very large, and played with water, enter about the middle of the *Focus*; the reſt of the furnace is raiſed upon this, 6 or 7 yards ſquare-wiſe, but tapering, ſo that the ſides draw by degrees towards each other, and the top-hole, at which they throw in baſkets of ſtone and fuel, is but about half a yard ſquare; into this place they put down a pole, to know how far it hath ſubſided after a certain time, and when they find it to have ſunk about a yard and a half, then they put in more, till the furnace be full again.

The furnace is very much like a common blackſmith's forge, about a yard and a half over, and of the ſame height; the hearth is of ſow-iron, much of the ſhape of a broad-brimed hat, with the crown downwards; this hollow place they fill and heap up with charcoal, and lay the ore, firſt broken into pieces as big as a pigeon's egg, all round about the charcoal upon the flat hearth, to bake or neal it, and they thruſt it in by little and little into the hollow, where it is melted by the blaſt, which is continued for about 12 hours, feeding it ſtill with new charcoal as it ſettles; then they pull out a ſtopple at the bottom of the wall, and all the glaſſy cinder, which is very liquid, runs out, and leaves the iron, which is never in perfect fuſion, in a lump at

the bottom; this they take out with great tongs, and put under heavy hammers, played with water, which at the ſame time beat off, or rather ſqueeze out the coarſer *Scoriæ*, eſpecially at firſt taking out of the furnace, and they form it after ſeveral heats into bars; they uſe no limeſtone, or any other thing to promote the flux; they get about a hundred weight of metal at one melting, which is the product of about three times ſo much ore.

The ore is got in *Fourneſs*; a diviſion of *Lancaſhire*, at leaſt 15 miles from *Milthorp*; ſome of it is hard, but feels ſoft and ſmooth, like velvet on the outſide; ſome of it again is as ſoft as clay, but all of it is red, and lies in beds like coal; the ſeveral ſorts of ores lie in one vein, which is ſometimes an inch, ſometimes a foot, and ſometimes again three or four yards broad, and many fathoms deep, between grey limeſtone rocks; but the hard ores lie uſually next the rocks on each ſide, and the ſoft ore in the middle; they frequently uſe the ſoft ore, and with good ſucceſs, as a medicine for the murrain in cattle, and for all diſeaſes in ſwine; to which latter, they give a good handful or two in milk.

The Giant's Cauſway *in* Ireland; *by Sir* Rob. Buckly. Phil. Tranſ. N° 199. p. 708.

THE *Giant's Cauſway* is in the county of *Antrim*, about 7 miles eaſt of *Colrain*, and 31 to the eaſt of the mouth of the river *Derry*; the coaſt there is very high above the ſea, but riſing gradually on the land ſide to the edge of the precipice, it is all covered with an excellent ſweet graſs; when you come to the precipice, there is no going down, the deſcent is ſo ſteep; but with much labour, and ſome hazard, it may be climbed up; from the foot of this precipice, there runs out northward into the ocean a raiſed cauſway of about 80 foot broad, and about 20 foot high above the reſt of the ſtrand; its ſides are perpendicular, it is about 200 foot in view to the water-ſide, but does not advance much farther under the ſurface of the water: This whole cauſway conſiſts of pillars of perpendicular cylinders, hexagons and pentagons, of about 18 and 20 inches in diameter, but lying ſo cloſe together, that nothing thicker than a knife will enter between the ſides of the pillars; the pillars do not conſiſt of joints, but each cylinder is one ſolid piece, and breaks croſſwiſe, or horizontally, and not lengthwiſe; and the pieces ſo broken off, have their bottoms as often convex or concave, as flat and even; and many ſuch pieces lie looſe on the ſand of the ſhore; when one walks upon the ſand below, the ſide of this cauſway hath its face

face all in angles, the ſeveral cylinders, to uſe the expreſſion, having ſome two, ſome three of their ſides open to view; the high precipice does alſo conſiſt of cylinders, tho' ſome are ſhorter and ſome longer, by which it may be climbed up as by ſo many ſteps; all the ſtones on that coaſt, whether ſingle or in cluſters, or that riſe up any where out of the ſand, are all cylinders, tho' of ever ſo different angles; and there are alſo ſome four-ſquared on the ſame ſhore.

Anatomical *Obſervations on the* Heads *of* Fowl; *by Dr.* Allen Moulen. Phil. Tranſ. N° 199. p. 711.

IN the heads of all the fowl Dr. *Moulen* had the opportunity of examining, he conſtantly found only one *Aquæductus*, or paſſage from the ears to the palate, whereas in men, quadrupeds, and ſome amphibious fiſh, there are always two, one on each ſide below the entrance of the noſtrils into the palate, and opening towards the noſtrils, for the more convenient reception of air, as is ſuppoſed; this paſſage in fowl is exactly in the middle of the palate, below the inſertion of the noſtrils into it; it is a membranous tube, capable of admitting a raven's, if not a gooſe quill in larger fowl, ſuch as turkeys, geeſe, *&c.* and reaches backwards as far as the communication from ear to ear, and hence it comes to ſerve both; whereas there is a neceſſity of two in thoſe animals, whoſe ears have no communication: He conſtantly found a hollow ſpace, between the two tables of the *Os Cuneiforme*, reaching from ear to ear, and as far forwards as the aforeſaid common *Aquæductus*, or rather, *Ductus aereus*, its mechaniſm ſeeming more to favour this than the former uſe; this cavity in all fowl reaches above the labyrinthus on each ſide, ſo that whatever impulſe is made on the *Tympanum* on the one ſide, may not only be very readily communicated by means of the internal air to the *Labyrinthus* of the ſame, but alſo to that of the oppoſite ſide; hence probably proceeds the quickneſs of hearing, and the vigilancy of fowl, notwithſtanding they want a *Cochlea*; the defect of which ſeems to be by this ſtructure more than ſupplied, no other animal, as far as is known, having any thing like it; it is not improbable, that the oppoſite ear is altogether as much affected by the ſound, as that next it, if not more; there are ſeveral *Laminulæ*, and pillars of hard bone, between the two tables in theſe cavities, deſigned, as may be ſuppoſed, partly for keeping them at a convenient diſtance, and partly for breaking of the air, ſo as to hinder echoes and confuſed repreſentations of objects, as it has been ingeniouſly obſerved by Sir. *J. Hoskins*, that

that pillars in churches very much prevented echoes: In the heads of woodcocks, beſides the paſſages now deſcribed, he found one on each ſide the bone, which makes the orbit of the eye, proceeding from the ear, and reaching forwards towards the ſetting on of the beak, near which they joined in one, and became under the ſkull a ſmall paſſage, leading to the cavity, by which the ears communicate, which is above deſcribed, and into which it enters; theſe paſſages are alſo in the heads of ſnites, and beſides, there is one over the *Sinus Longitudinalis*, and another over the *Sinus Lateralis* of the brain. *Note*, that in the killing of ſnites, and ſmaller birds, if care be not taken not to bruiſe the head, theſe paſſages cannot be diſcovered, on account of extravaſated blood; obſerve alſo, that the *Laminulæ* and bony pillars are every where to be obſerved, where there is a paſſage, excepting under the ſkull, in the paſſage from the ſetting on of the bill to the firſt paſſage deſcribed: In the heads of parrots and paroquets, beſides the firſt deſcribed paſſage, between the two tables, he obſerved cells opening into other cells, and theſe again into others, ſo that there was ſcarcely any part of the ſkull that they did not take up; and this did not only appear, by pouring into one ear, freed from its drum, the other being alſo removed, a tincture of cochineel, and then blowing it into all theſe cells, ſo that no part was free of the tincture; but it was alſo manifeſt to the naked eye, notwithſtanding, that ſometimes it was difficult to trace their communications, by reaſon of the number of the *Laminulæ*, and the aforeſaid pillars: In ſinging birds, the ſtructure of theſe paſſages is like that of the parrot and paroquet, only that the pillars and *Laminulæ* are leſs than they ſhould ſeem to be in proportion to the heads; from whence it is probable, that theſe birds are by this ſtructure enabled to diſtinguiſh ſounds and notes, and alſo imitate them better, having a more muſical ear: In the heads of pullets, geeſe, ducks, he found only the firſt deſcribed paſſage diſtinctly, but in pluvers, buſtards, and ſome others, he found another paſſage, that went over the *Sinus Lateralis* of the brain, from ear to ear; which ſeems to be deſigned to make them more watchful than domeſtic fowl, or thoſe that live much on the water, becauſe they are liable to a great many accidents that the others are exempt from: In the ears of all the fowl he could examine, he never found any more than one bone and a cartilage, which made a joint with it, that was eaſily moveable; the cartilage had generally an epiphyſe or two, one on each ſide, which were very flexible, as itſelf alſo was; the bone was ſmall and very hard, having at the end of it a broad plate of the ſame

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ſubſtance, which was very thin, and on which it reſted as on its baſis: Dr. *Moulen* obſerved three pair of nerves in all the broad-billed birds, and in all ſuch as grope for their food out of ſight, as ſnites, woodcocks, curlews, geeſe, ducks, teal, widgeon, &c. theſe nerves are very large, equalling almoſt the optic nerve in thickneſs; they begin a little more forwards than the auditory nerve from a ſmall protuberance, which ſeems to be made for them; one of them goes over the optic nerve in the orbit of the eye, the other two go under the eye; two are diſtributed near the extremity of the upper bill, and are there very much expanded, paſſing thro' the bone into the membrane, which lines the roof of the mouth; the third pair is diſtributed near the end of the lower bill, and is ſubdivided like the former: *Note*, that birds, that pick their food where they can ſee it, have not theſe nerves, and that the pair of nerves, belonging to the upper bill, is conſiderably ſmaller in proportion to the fowls than thoſe obſerved above; whence it is probable, that theſe nerves were deſigned for ſome conſiderable uſe, both on account of their number, and their bulk, which is to enable them to diſtinguiſh their food, there being a neceſſity of a more exquiſite ſenſe in theſe fowl than in any other: All the eyes of fowl and fiſh that the doctor had ever examined, were more or leſs cartilaginous; for the *Sclerotis* is a cartilage *ſui generis*, eſpecially near the *Cornea* in all theſe animals; and in the larger ſorts of both, he found the whole *Sclerotis* cartilaginous: In the eyes of fiſh he obſerved, that the *Proceſſus Ciliaris* is not faſtened to the joining of the *Cornea* and *Sclerotis*, as in all other animals he diſſected, ſo as to hinder the aqueous humour to go any farther backwards; for he conſtantly obſerved, that the aqueous humour may move a good way backwards in ſome, and in others almoſt as far as the optic nerve: In all the fiſh he examined, he found a membrane which covered the *Tunica Cornea*, ſo as to prevent any water coming to it; and this anſwers the *Membrana Nictitans* in fowl, and reaches on all ſides to the ſkin of the fiſh, to which it is faſtened; it is tranſparent and pretty thin, as is alſo the *Cornea*, if compared with that of quadrupeds: He frequently obſerved in ſmaller fowl, that the membrane of the drum was double; for by gently pulling away the membrane which lines the tube of the ear, he obſerved at the bottom of it a tranſparent membrane, which at firſt he took to be the membrane of the drum, but upon examination, he found that the membrane of the drum was ſtill entire, and in its proper place; he ſometimes alſo obſerved this in larger fowl, in a ſeal, and in ſome other animals.

The

The making of Braſs; *by Mr.* Tho. Povey. Phil. Tranſ. N. 200 p. 735.

Calamine is dug out of ſeveral mines in the weſt of *England*, as about *Mendip*, &c. about 20 foot deep; it is burnt or calcined in a kiln or oven made red hot, then it is ground to powder, and ſifted to the fineneſs of flower, and mixt with ground charcoal, becauſe the *Calamine* is apt to be clammy, to clod, and not ſo apt to incorporate; then they put ſeven pounds of *Calamine* into a melting pot that holds about a gallon, and about five pounds of copper, uppermoſt; the *Calamine* muſt be mixed with as much coal as will fill the pot; this is let down with tongs into a wind-furnace 8 foot deep, wherein it remains 11 hours; they caſt off not above twice in 24 hours; one furnace holds eight pots; after melting it is caſt into plates or lumps: Forty five pounds of raw *Calamine* produce 30 pounds burnt or calcined: Braſs ſhurff ſerves inſtead of ſo much copper, but this cannot be always procured in large quantities, becauſe it is a collection of pieces of old braſs, which is uſually got in ſmall parcels: The beſt guns are not made of malleable metal, and cannot be made of pure copper or braſs, but it is neceſſary to put in coarſer metals to make it run cloſer and ſounder, as lead and pot-metal; bell-metal is copper and tin, and pot-metal is copper and lead; about 20 pounds of lead is uſually put to 100 pounds of pot-metal; but about ſix pounds are ſufficient to be put to 100 pounds of gun-metal: The *Calamine* ſtone was heretofore brought from *Poland*, but ſince from hence by the *Dutch*: The manufacture of braſs was for ſeveral hundred years kept private in *Germany*, wherein many thouſands were employed, and ſome raiſed themſelves to conſiderable eſtates.

The Humming Bird; *by Mr.* Hamerſly. Phil. Tranſ. N° 200 p. 760.

THERE is in moſt parts of *America* a bird called by the *Engliſh* the *Hum-Bird*, by the *Spaniards Tomineius*, of an excellent ſhining green colour and very reſplendent, the colour ſomething reſembling ſome of our *Engliſh* drake's heads; it is found in the colder parts of *America*, as well as in the hotter; it is the ſmalleſt of all birds; both the leg and foot together are but half an inch, the other parts are anſwerable, and the whole trunk of the body is not quite an inch: Upon weighing one as ſoon as it was killed, it was found to be only the tenth part of an ounce avoirdupois, which is much about the weight of a coined

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ſix-pence; and upon weighing a titmouſe, which is the ſmalleſt bird here in *England*, it weighed above two ſhillings: The neſt of the humming-bird is made of cotton-wool, in form and bigneſs like the thumb of a man's glove, with the taper end ſet downwards; the eggs are oval, and of the bigneſs of a pea: They feed by thruſting their bill and tongue into the bloſſoms of trees, and ſo they ſuck the ſweet juice of honey from them, which they do without ſitting, by a hovering motion of their wings; what is ſaid of their being curious ſinging birds, is not true; they are wore as pendants in the ears, by the *Indian Soggamores*; the name of this bird is from a noiſe, like a ſpinning-wheel, which he makes in flying, but the author of this account never obſerved any ſuch thing, beſides, that their body and wings are too ſmall to ſtrike air enough to make any noiſe; it is a ſolitary bird, no more than two being ſeen together at a time, *viz.* the male and female, and they are eaſily diſtinguiſhable, the former being ſomewhat bigger than the latter: If one ſhould take the wing of a ſmall bird, and ſtand four or five yards from a candle, and open the wing, and look thro' it, he would ſee very elegant colours of red and green, which latter doth ſomething reſemble the colour of this bird.

An Account of Virginia; *by Mr.* J. Clayton. Phil. Tranſ. N° 201. p. 781.

THE air and temperature of the ſeaſons in *Virginia* are much influenced by the winds, both as to heat and cold, drought and moiſture; and their variations are very notable, there being often great and ſudden changes; the north and north-weſt are very nitrous and piercing, cold and clear, or elſe ſtormy; the ſouth and ſouth-eaſt are hazy and ſultry hot; their winter is a fine clean and dry air, which renders it very pleaſant; their froſts are ſhort, but ſometimes very ſharp, ſo as to freeze rivers three miles broad, and ſometimes *Potomack*, in places where it is nine miles over; Mr. *Clayton* obſerved, that it freezes hardeſt, when from a moiſt ſouth-eaſt, on a ſudden the wind paſſing by the north, a nitrous ſharp north-weſt blows, not with high guſts, but with a ſharp briſk air; and the vales, which then ſeem to be ſheltered from the wind, where the air is moſt ſtagnant and moiſt, are frozen the hardeſt, and there the fruits are moſt ſubject to blaſt, than where the air hath a free motion; ſnow falls there ſometimes very plentifully, but it rarely continues above a day or two; their ſpring is about a month earlier than in *England*; in *April* they have frequent rains, ſometimes ſeveral ſhort and ſudden guſts of wind; in *May* and *June* the heat encreaſes, and

+ They catch inſects in the bloſſoms and do not ſuck their ſweetneſs

it is much like our ſummer, being mitigated by gentle breezes, that ariſe about 9 o'clock, and decreaſe and decline as the ſun riſes and falls; in *July* and *Auguſt* theſe breezes ceaſe, and the air becomes ſtagnant, ſo that the heat is violent and troubleſome; in *September* the weather uſually breaks ſuddenly, and there falls generally very conſiderable rains; when the weather breaks, many fall ſick, this being the time of an endemical ſickneſs, for ſeaſonings, cachexies, fluxes, ſcorbutic dropſies, gripes, and the like; which are owing to this, that the ferment of the blood being raiſed too high by the extraordinary heat, and the tone of the ſtomach relaxed, when the weather breaks, the blood palls, and like overfermented liquors is depauperated, or turns eager and ſharp, and there is a crude digeſtion, whence the above diſeaſes may be ſuppoſed to ariſe: The influence of the air on human bodies is very ſurpriſing, not the leaſt alteration or change therein but ſenſibly affects thoſe troubled with the gripes, and the ſmalleſt black fleeting cloud that ariſes, as it comes nigher encreaſes the pain; thunder and lightning there are very dreadful, ſometimes burſting out of the cloud, and dividing it into two, which ſeem to be ſhot a mile aſunder; it is incredible how it will ſtrike down large oaks, ſhatter and ſhiver them, and ſometimes twiſt a tree round; formerly, when the country was not ſo open, the thunder was fiercer, and the roads would ſeem to have entire caſts of brimſtone, and the air have a perfect ſulphureous ſmell; little ſorts of whirl-winds are frequent there, whoſe diameter ſometimes exceeds not two or three yards, ſometimes 40, which whirling round in a circle, paſs along the earth, according to the motion of the cloud, from whence they iſſue, and as they paſs along in their gyrous or circular motion, they carry aloft the dry leaves into the air, which often fall again in places very remote; Mr. *Clayton* had ſeen them deſcend in a calm ſun-ſhiny day, as if they had come from the heavens in great ſhowers; and hence many preternatural ſhowers may be accounted for.

Between the two capes, the ſoutherly called cape *Henry* and the more northerly, cape *Charles*, there runs up a great bay, called the bay of *Cheeſepeak*, in ſome places nine leagues over, in moſt places ſeven, dividing *Virginia* into two unequal parts; on the eaſt ſide of this bay, there lies a narrow neck of land, which makes the counties of *Northampton* and *Accomack*; on the weſt ſide of the bay four great rivers ariſe from a ridge of mountains, *viz.* *James* river, *York* river, *Rapahanack*, and *Potomack*, and theſe rivers plentifully water all the other parts of *Virginia*, emptying themſelves into the great bay; *Potomack* is a very large

large river, in many places nine miles over, it is navigable near two hundred miles; the other rivers are each much about three miles over; and *James* river is navigable at leaſt 80 miles; within four or five miles of *James* town, *James* river, and *York* river, are not above four or five miles aſunder; and ſloops of conſiderable burthen may ſail up the branches of the two rivers, till they come within a mile of each other; *York* river is diſtant from *Rapahanack*, in ſome places, not above 10 or 12 miles; *Rapahanack* from *Potomack* not above ſeven miles in one place, tho' it may be 60 in others; the heads of the branches of the rivers interfere, and are locked the one within the other: The tides in theſe rivers ebb and flow regularly about two foot perpendicular at *James* town; and it flows there, tide and half tide: As far as the ſalt waters reach, the country is reckoned leſs healthy; in the freſhes they are more rarely troubled with the ſeaſonings, and thoſe other endemical diſtempers about *September* and *October*: It is remarkable in *Virginia*, that generally twice a year, *viz.* ſpring and fall, at certain ſpring-tides, moſt of the cattle will run to the river, tho' 20 or 30 miles off, to drink the ſalt water, at which time there is no ſtopping of them: In general, the waters in their ſprings are ſomewhat more eager than thoſe in *England*; for they require a greater quantity of malt to make ſtrong beer than our *Engliſh* waters, and they will not bear ſoap.

Truffles; *by Dr.* Tancred Robinſon. Phil. Tranſ. N° 202. p. 824.

THE *Tubera Terræ*, obſerved at *Ruſhton* in *Northamptonſhire*, are the true *French* truffles, the *Italian Tartuffi* or *Tartuffole*, and the *Spaniſh Turmas de Tierra*; at *Florence*, *Rome*, and *Naples*, they are thrice larger, where they eat them as great dainties, either fried in ſlices with butter or oil, ſalt and pepper, or elſe out of pickle, and they are often boiled in their ſoup: Theſe obſerved in *England*, are all included in a ſtudded bark or coat, the *Tubercules* reſembling the *Capſules* or ſeed-veſſels of ſome mallows and *Alcæas*; the internal ſubſtance is of the conſiſtence of the fleſhy part in a young cheſnut, of a pale colour, of a rank ſcent and unſavoury, ſtreaked with many white veins or threads; the whole is of a globous figure, tho' unequal and chinky: What theſe truffles are, neither ancients or moderns have clearly informed us; ſome will have them to be calloſities, or warts bred in the earth; others call them ſubterraneous muſhrooms; they are moſt tender in the ſpring, tho' after ſhowers and ſultry weather, they may be plentifully found in autumn;

moiſture ſwells them, and lightning may diſpoſe them to emit their particular ſcent, ſo alluring to ſwine, for ſome of the ancients called them *Ceraunia*.

Dr. *Hatton* obſerved fibres iſſuing out of ſome of theſe *Tubera*, which lay ſpit-deep under ground, ſo that they may be plants *ſui generis*, and their furrowed *Papillæ* analogous to, if not ſeed-veſſels; for ſeveral vegetables bear their ſeed near the root, as the *trifolium ſubterraneum tricoccum reticulatum*, *floſculis longis albis*, moſt of the *Arachidnas*, and ſome other pulſe, which flower above, but ſeed under ground; as to the truffles lying ſo deep, they have that in common with many roots that ſhoot up ſtalks above the earth; to inſtance only in the *Terræ Glandes*, in *Engliſh*, peaſe-earth-nuts, which are dug up and eaten by the poor people; the roots of our *Bulbocaſtanum*, of the umbelliferous kind, commonly called keppernuts, pignuts, and gernuts in the north, lie very deep, and fatten hogs, which are very greedy of them.

An Earthquake *in* Sicily; *by Mr.* Martin Hartop. Phil. Tranſ. N° 202. p. 827.

IT ſeems highly probable, that theſe tremblings of the earth proceed from the ſame inflammable matter, which, finding a way at other times thro' *Mongibello*, breaks out ſo furiouſly in fire and ſmoke: The eruptions of theſe mountains are of two ſorts; the one not ſo violent, as very much to diſturb the adjacent country; and this happens once in two or three months, and laſts three or four days; the other is more furious, and of longer continuance, and is obſerved at *Naples* to happen to mount *Veſuvius* once in about 80 years; that in 1632 was ſo very violent, that it threw rocks three miles into the air; now from the burning or not burning of this hill, *Naples* concludes its ſafety or danger from earthquakes; for doubtleſs the matter is continually burning under the mountain; and thoſe vaſt clouds of ſmoke, which daily iſſue out at the top, if the cavity happen by any rock, or inward alteration to be ſtopped, muſt deviate thro' other paſſages under ground, heaping up there continual magazines for a future calamity: Now this combuſtible matter ſeems to be nothing other but nitre, mixed with ſome other minerals and ſulphur; for he that has ſeen the method of making of tartar by deflagration, where an equal quantity of pulverized nitre is mixed, has an exact type of theſe burning hills; for after each ſpoonful that is put into the burning crucible, there ariſes firſt a black thick ſmoke, after which the fired mineral boils up, as if it would run over the top of the crucible. The

The motion of the earth is not from the perpendicular, but horizontal, as appears by the cracks in the earth, which are now to be found all over *Sicily*; it is a vibration ſo quick, that it cracks the glaſs in the windows, and the reciprocations of a lute-ſtring are not more frequent than it; now when the vibrations are ſo quick, and the body moved ſo large, the motion muſt be prodigiouſly violent.

To find the Parallax of the fixed Stars; *by Dr.* Wallis. Phil. Tranſ. N° 202. p. 844.

Galileo hath ſuggeſted ſeveral things conſiderable, in order to the obſerving of the parallax of the fixt ſtars; as that the times of obſervations ſhould be, when the ſun or earth are in the *Tropics*, or as near to them as poſſible; becauſe at thoſe times, if at any, will be the greateſt difference of their meridional altitude: That the ſtars to be obſerved, ſhould be ſuch as are as near as poſſible to the pole of the ecliptic; for ſuch as are in its plane, or near it, tho' they may be ſometimes nearer, and ſometimes farther from us, which might ſomewhat alter their apparent magnitude, if it were ſo much as obſervable, yet it would alter little or nothing the parallactic angle: *Galileo* alſo obſerves, that in a buſineſs ſo nice, the ordinary inſtruments of obſervation, tho' pretty large, would be inſufficient for this purpoſe; and he propoſes, that by the ſide of ſome edifice or mountain, at the diſtance of ſome miles, the ſetting of ſome noted *Star*, as that of *Lucida Lyræ* might be obſerved at thoſe different times of the year, which might be equivalent to an inſtrument, whoſe radius were ſo large; which would be a good expedient if practicable; but Dr. *Wallis* doubts the denſity of our atmoſphere is ſo great, as that it would be hard to diſcern a ſtar juſt at the horizon, or even within ſome few degrees of it; and that the refraction would there be ſo great, and ſo uncertain, as not to anſwer ſo curious an obſervation: What occurred to the Doctor upon theſe conſiderations, was to this purpoſe; that ſome circumpolar ſtars, nearer to the pole of the *Equator* than is our *Zenith*, and not far from the pole of the *Zodiac*, ſhould be made choice of for this purpoſe; and in caſe the meridional altitude be diſcernibly different at different times, ſo will alſo be their utmoſt eaſt and weſt azimuth, which may be better obſerved than their riſing and ſetting; and this will not be obnoxious to the refraction, as the meridional altitude is; for tho' the refraction do affect the altitude, yet not the azimuth at all; and we may here have choice of ſtars for the purpoſe, which in obſervations from the bottom of a well, we

we cannot have, being there confined to those only which pass very near our *Zenith* tho' very small stars: Dr. *Wallis* takes it for granted, as a thing at least very probable, that the fixt stars are not all, as was wont to be supposed, at the same distance from us; but the distance of some, is vastly greater than that of others; and consequently, tho' as to the more remote, the parallax may be undiscernible, it may perhaps be discernible in those that are nearer to us; and those we may reasonably guess, tho' we are not sure of it, to be nearest to us, which appear largest and brightest, as are those of the first and second magnitudes; and there are at least of the second magnitude pretty many not far from the pole of the ecliptic, as that in particular in the shoulder of the lesser bear; and in case we fail in one, we may try again and again some other star, which may chance to be nearer us than what we try at first; and stars of this bigness may be observed by an ordinary telescope, even in the day-time; especially when we know justly where to look for them: The manner of observation the Doctor conceives may be thus; having first made choice of the star we mean to observe, and having then considered, which is not hard to do, where such star is to be seen in its greatest east or west azimuth; it may be then convenient to fix very firm and steadily on some tower, steeple, or other high edifice, in a convenient situation, a good telescopic object-glass in such a position, as may be proper for viewing that star; and at a due distance from it near the ground, build some little stone wall, or such like place, on which to fix the eye-glass, so as to answer that object-glass; and having so adjusted it, as thro' both to see that star in its desired station, which may best be done, whilst the star is to be seen by night in such situation, near the time of one of the solstices; let it be there fixed so firmly, as not to be disturbed, and the place so secured, as that no body come to disorder it, and care be taken so to defend both the glasses, as not to be endangered by wind and weather; in which contrivance Dr. *Wallis* owns himself beholden to Mr. *J. Caswell* of *Hart-hall Oxford*, for his advice and assistance, and with whom he had for many years communicated the whole matter: This glass being once fixed and a micrometer fitted to it, so as to have its threads perpendicular to the horizon, to avoid any inconvenience, which might arise from diversity of refraction, if there be any, the star may then be viewed from time to time, for the following year or longer, to see if any change of azimuth can be observed. The reason why the Doctor recommends as a convenient star for this purpose, the shoulder of the lesser bear, is that there is adhering

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to it a very ſmall ſtar, which the *Arabs* call *Alcor*, and which *Hevelius* in his obſervations finds to be diſtant from it about 9′ and 5 or 10″; ſo that beſides the advantage of diſcovering the parallax of the greater ſtar, if diſcernible; the difference of parallax of that and of the leſſer ſtar, being both within the reach of a micrometer, may do our buſineſs as well; for if that of the greater ſtar be diſcernible, but that of the leſſer, either not diſcernible or leſs diſcernible, their different diſtances from each other at different times of the year, may, perhaps, without farther *apparatus*, be diſcerned by a good teleſcope of a competent length, furniſhed with a micrometer, if carefully preſerved from being diſordered in the intervals of the obſervations; and diſcover at once, both that there is a parallax, and that the fixt ſtars are at different diſtances from us; wherein his meaning is not that the inſtrument or micrometer ſhould be removed for the obſerving of the leſſer ſtar, but that, when the azimuth of the greater ſtar is taken, by a micrometer conſiſting of ſeveral fine threads parallel and tranſverſe, may at the ſame time be obſerved the diſtance of the two ſtars from each other, in that poſition, both being at once within the reach of the micrometer; which diſtance, the inſtrument remaining unmoved, if it be found, at different times of the year, not to be the ſame, this will prove that there is a different parallax of theſe two ſtars: This latter part of the obſervation, of their different diſtances at different times, he ſuggeſts as more eaſily practicable, tho' not ſo nice as the former; for it may be done, he thinks, without any farther *apparatus* there than a good teleſcope of ordinary form, furniſhed with a micrometer, which is carefully kept unvaried during the interval of theſe obſervations; and if this part only of the obſervation, without the other, be purſued, it matters not tho' the two obſervations near the two ſolſtices be, one at the eaſtern, the other at the weſtern azimuth, whereby both may be taken in the night time; for the diſtance muſt at both azimuths be the ſame; if, after obſerving the azimuth of the greater ſtar, it be neceſſary to move the micrometer for meaſuring its diſtance from *Alcor*, that may be done another night, and it is not neceſſary to be done at one obſervation, for that diſtance cannot be diſcernibly varied in a night or two.

Obſervations on the Animalcula *in* Pepper-water, *&c. by Sir* Edm. King. Phil. Tranſ. N° 203. p. 861.

HAving ſteeped oats in rain-water for ſome days, and viewing it with the naked eye, a ſubſtance was obſerved, reſembling what is uſually called a mother on other liquors, and laying

ing the quantity of a ſmall pin's head on the object-plate of a microſcope, 7 or 8 ſorts of *Animalcula* of different ſizes and ſhapes were plainly to be diſcerned ſwimming in this ſubſtance, ſee Fig. 1. Plate III. they were all very nimble in their motions, and were by computation magnified ſeveral thouſand times: The thin ſcum on pepper-water, which reſembled flakes of ſalt on ſome ſorts of human urine, applied in the ſame manner to the object-plate of the microſcope, was only cluſters of *Animalcula*, that had liquid matter enough to ſwim in, and their numbers, motions, variety and minuteneſs were ſurpriſing: In a decoction of herbs that was ſtrained, were ſeen creatures like little eels, ſharp at both ends, and with a wriggling motion Fig. 2: Theſe ſmall animals abovementioned reſemble the nature of fiſh in ſeveral reſpects; firſt, they flock together, and lie cloſe, as if they were in ſhoals, like carps in a pond; when deprived of their liquor, they will ſeem to ſtruggle for want of it, and then in a minute or leſs, they will ſeem dead on the object-plate; but putting a little water to them, in half a minute they will move themſelves again, and by degrees begin to ſwim faintly at firſt, and then recovering their ſtrength again, they will perform their briſk motions as vigorous as ever: Theſe *Animalcula* chuſe for the moſt part the top of the liquor, poſſibly for the ſake of the air; now as a further confirmation, that they are *Animalcula*, which is doubted of by ſome, the following obſervations may ſerve; if you take a fine needle, and put the point into ſpirit of vitriol, and prick a ſmall drop with it, theſe minute animals will from moving briſkly about, ſpread themſelves and appear to tumble down dead Fig. 3; diſſolved ſalt produces the ſame effect upon them, with this difference, that inſtead of becoming flat, as thoſe with ſpirit of vitriol did, they will ſhrink into an oblong round form: Tincture of ſalt of tartar kills them more immediately; but yet they will be ſo ſick, as appears by convulſive motions, that they will grow faint and languid apace, and then fall down dead to the bottom, without any change in their ſhape: Ink kills them as ſoon as ſpirit of vitriol, but makes them ſeem to ſhrink ſeveral ways: Freſh blood kills them almoſt as ſoon as ſpirit of vitriol; urine kills them too in a little time, tho' not ſo ſoon; ſugar diſſolved, like ſalt, kills them alſo, and with it ſome die flat, and ſome round; ſack will kill them, but not ſo ſuddenly as the other liquors.

The Manner of making and tempering Steel, *with a Conjecture at the Method of the Ancients to Steel their* Picks *for hewing of* Porphyry; *by Dr.* Liſter. Phil. Tranſ. N° 203. p. 865.

THE *Egyptian* obeliſks, thoſe celebrated and ſtupendous monuments of antiquity, are all of porphyry, and moſt of them are curiouſly carved with a vaſt number of figures, which was one of the ways of writing amongſt the ancient *Egyptians*; theſe figures demonſtrate the facility that nation had of engraving on porphyry, a ſtone which no tool will now touch, nor any thing leſs than emery or diamond powder affect: Mr. *Ray* aſſures us, that all the obeliſks at *Rome*, engraven with hieroglyphics, are of one and the ſame kind of ſtone; *viz.* a marble of a mixt colour, red and white, very hard, without ſuffering the leaſt injury by the weather for many ages. There is certainly ſomething loſt in this age, as to the manner of ſteeling of tools, and the proceſſes, now uſed by moſt nations, are fraudulent, and a poiſoning of iron by certain mineral ſalts, rather than a true making of ſteel: The moſt ancient account is that given us by *Ariſtotle*, *l.* 4. *c.* 6. *Meteorologicor.* which yet is very obſcure and imperfect, the paſſage is this; wrought iron itſelf may be caſt ſo, as to be made liquid, and to harden again; and they are wont to make ſteel thus; for the *Scoria* of iron ſubſides, and is purged off by the bottom; and when it hath been often defecated, and made clean, this is ſteel; but this they do not often, becauſe of the great waſte, and that it loſes much weight in refining; but iron is ſo much the more excellent, the leſs recrement it hath; thus far *Ariſtotle*. This account is a little confuſed and not eaſily intelligible; it is true indeed, that iron is ſtill better, the more it is purged; ſo in our *Engliſh* furnaces, thoſe bars, which are wrought out of a loop, taken out of the finery-hearth, or ſecond forge, are much better iron than thoſe made in the bloomery, or firſt hearth, becauſe more purged of the droſs, and accordingly they give a double price; it is alſo as true, that even wrought iron may be melted as often as you pleaſe; again, iron, as often as it is melted and purged, loſes much of its weight; but after all, iron of itſelf, how oft ſoever it is purged and refined, will never become ſteel; but of it thus purged, the beſt ſteel doubtleſs may be made; and this is the moſt favourable conſtruction that can be put on this paſſage of *Ariſtotle*.

The manner of making true ſteel is thus faithfully deſcribed by *Agricola*, *l.* 9. *de re Metallica*; and to confirm the antiquity

thereof, this way of making ſteel is by *Kircher* ſaid to be now in uſe in the iſland of *Ilva*, a place famous from all ages, even from the times of the *Romans* for that metal alone, down to our days: Make choice of iron, which is apt to melt, and yet hard, and which may eaſily be wrought with the hammer; for altho' iron, which is made of vitriolic ore, may melt, yet it is ſoft, or brittle, or eager: Heat a parcel of ſuch iron red hot, and cut it into ſmall pieces, and then mix it with a ſort of ſtone which eaſily melts; then ſet in the ſmith's forge or hearth a crucible or diſh of crucible metal, a foot and a half broad, and a foot deep; fill the diſh with good charcoal, and ſet looſe ſtone about it, to keep in the mixture of ſtone and pieces of iron; as ſoon as the coal is thoroughly kindled, and the diſh red hot, give the blaſt, and let the workman put on by little and little, all the mixture of iron and ſtone he deſigns; when it is melted, let him thruſt into the middle of it three, four or more pieces of iron, and boil them therein for five or ſix hours, with a briſk fire; and putting in his rod, let him often ſtir the melted iron, that the pieces may imbibe the ſmaller particles of the melted iron, which particles conſume and thin the groſſer ones of the iron pieces, and are, as it were, a ferment to them, and make them tender: Let the workman now take one of the pieces out of the fire, and put it under the great hammer to be drawn out into bars, and wrought; and then hot as it is, plunge it forthwith into cold water: Thus tempered let him work it again upon the anvil and break it; and viewing the fragments, let him conſider whether it look like iron in any part of it, or be wholly condenſed, and turned into ſteel: Then let the pieces be all wrought into bars; which done, give a freſh blaſt to the mixture, adding a little freſh matter to it, in the room of that which had been drank up by the pieces of iron, which will refreſh and ſtrengthen the remainder and make it purer ſtill, then put the pieces of iron again into the diſh; each of which, as ſoon as it is red hot, let him beat into a bar upon the anvil, and caſt it hot, as it is, into cold water; and thus iron is made into ſteel, which is much harder and whiter than iron.

Pliny, ſpeaking of iron, ſays, *fornacum maxima differentia eſt; in iis equidem nucleus ferri excoquitur ad indurandam aciem, alioque modo ad denſandas incudes Malleorumve roſtra*; from this paſſage it ſhould ſeem, that the ancients had one way to make ſteel, and another way to harden or temper their tools, particularly ſuch as picks and anvils; it is alſo plain, that *nucleus ferri* was melted down in both: Again, the difference was

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in the furnaces, that is, in the manner of ordering the iron to be made into ſteel, or for the extraordinary hardening of the heads and bitts of tools, and not in the matter of which they were made; for both was done by boiling them in molten iron: It cannot be doubted but by *nucleus ferri* muſt be meant well purged iron, the ſame which *Ariſtotle* calls ειργασμενον σιδηρον; for why elſe ſhould he tell us that wrought iron itſelf may be made liquid, ſo as to harden again, that is caſt again into ſow-metal, if it was not to explain to us the manner of making ſteel, which they did probably according to the direction above delivered; that is, not only boil the iron in its own ſow-metal, or liquid iron, but hammer it alſo, and after that quench it in cold water; as to the ſteeling of their tools, they boiled them in ſow-metal, to ſuch a degree of hardneſs or temper, as was requiſite, and did not afterwards hammer them; for which there might be ſeveral reaſons; as firſt, that it is eaſier to work iron than ſteel into any figure, that being far ſofter and more ductile and looſe; again, it is certain, that iron by ignition is ſpoiled or corrupted, ſo that the oftner it is purged, tho' it were ſteel, it would the more relent; whence the ancients knowing, that in making their tools of ſteel, they muſt conſiderably looſen it and make it abate of its temper, they therefore firſt ſhaped them, and then gave them a ſtrong body of ſteel and temper together, and ſo had nothing elſe to do but to finiſh them on the grind-ſtone and hone, to ſet the point or edge.

A Deſcription of certain Shells *found in the* Eaſt-Indies; *by M.* Witzen. Phil. Tranſ. N° 203. p. 870.

THERE are found on the coaſts of *Malabar* and *Ceylon* certain cockles or ſhells, containing a fiſh that lives in the bottom of the ſea, fixt to the body of the ſhell; and at a certain ſeaſon of the year, they caſt their ſeed, which produces a ſort of matrix of the ſize of this long body, Fig. 4. Plate III. which is wrinkled like a ſauſage, abounds in a great number of round cells, which are ſo many matrices, each producing its little ſhell-fiſh; which quit not their cells till they are grown to ſuch a bigneſs and maturity, as their weight breaks them off and looſens them from their cells, and ſo from their common matrix, which remains faſtened to the bottom of the ſea, by the great end, the other moving about freely in the water; this matrix hath a back of a greyiſh colour, and the belly is whiter, which is that part that is full of cells; the ſkin which covers it, is very like that of ſtock-fiſh or other dried fiſh: Fig. 5. repreſents a ſhell found in the

river of *Goa*, which contains a ſort of oiſter; it is very rare, and its ſhell powdered is eſteemed a good medicine.

The proportional Heat of the Sun *in all Latitudes, with the Method of Collecting the Same; by Mr.* Edm. Halley. Phil. Tranſ. N° 203. p. 878.

IF we conſider the action of the ſun as the only cauſe of the heat of the weather, Mr. *Halley* thinks, that under the pole the ſolſtitial day may be as hot as it is under the equinoctial, when the ſun comes vertical, or over the *Zenith*; and that for this reaſon, that during the 24 hours of that day under the pole, the ſun's rays are inclined to the horizon in an angle of 23 ½ degrees, and under the equinoctial, tho' he come vertical, yet he ſhines no longer than 12 hours, and is again 12 hours abſent; and that for 3 hours 8 minutes of theſe 12 hours he is not ſo much elevated as under the pole; ſo that he is not 9 of the whole 24 hours higher than he is there, and 15 hours lower: Now, the ſimple action of the ſun is, as all other impulſes or ſtrokes, more or leſs forcible, according to the ſine of the angle of incidence, or to the perpendicular let fall on the plane; whence the vertical ray, being that of the greateſt heat, being put radius, the force of the ſun on the horizontal ſurface of the earth will be to that, as the ſine of the ſun's altitude at any other time: This being allowed, it will then follow, that the time of the continuance of the ſun's ſhining being taken for a baſis, and the ſines of the ſun's altitudes erected thereon, as perpendiculars, and a curve being drawn thro' the extremities of thoſe perpendiculars, the area comprehended will be proportional to the collection of the heat of all the rays of the ſun in that ſpace of time; hence it will follow, that under the pole, the collection of all the heat of a tropical day is proportional to a rectangle of the ſine of 23 ½ deg. into 24 hours, or the circumference of a circle; that is, the ſine of 23 ½ deg. being nearly 4 tenths of radius; as $\frac{4}{10}$ into 12 hours; or the polar heat is equal to that of the ſun continuing 12 hours above the horizon, at the height of 53 deg. than which the ſun is not five hours more elevated, under the equinoctial: But that this may be better underſtood in Fig. 4. Plate II. the area Z G H H is equal to the area of all the ſines of the ſun's altitude under the equinoctial, erected on the reſpective hours from ſunriſing to the *Zenith*; and the area ☌ H H ☌ is in the ſame proportion to the heat for the ſame 6 hours under the pole on the tropical day; and ☉ H H Q is proportional to the collected heat of 12 hours or half a day under the pole; which ſpace O H H Q

is

is visibly greater than the other area HZGH, by as much as the area HGQ is greater than the area ZGO; which, that it is so, is visible to sight, by a great excess; and so much in proportion does the heat of twenty-four hours sun-shine under the *Pole*, exceed that of the twelve hours under the *Equinoctial*; whence *Cæteris Paribus*, it is reasonable to conclude, that were the sun perpetually under the *Tropic*, at the *Pole* it would be at least as warm, as it is now under the *Line* itself: But whereas the nature of heat is to remain in the subject, after the cause that heated it is removed, and particularly in the air; under the *Equinoctial*, the 12 hours absence of the sun does very little abate the motion impressed by the past action of his rays, wherein heat consists, before he rise again; but under the *Pole*, the long absence of the sun for six months, wherein the extremity of cold obtains, does so chill the air, that it is as it were frozen up, and cannot, before the sun has got far towards it, be any way sensible of his presence, his beams being obstructed by thick clouds, and perpetual fogs and mists; and by that atmosphere of cold, as the honourable Mr. *Boyle* expresses it, proceeding from the everlasting ice, which in immense quantities does chill the neighbouring air, and which the too sudden retreat of the sun leaves unthawed, to increase again, during the long winter that follows this short interval of summer: But the different degrees of heat and cold, in different places, depend in a great measure on the accidents of the neighbourhood of high mountains, whose height exceedingly chills the air brought by the winds over them; and of the nature of the soil, which variously retains the heat, particularly the sandy, which in *Africa* and *Arabia*, and generally where such sandy deserts are found, do make the heat of the summer incredible to those that have not felt it: In prosecution of this first thought, Mr. *Halley* has solved the problem generally; *viz.* to give the proportional degree of heat, or the sum of all the sines of the sun's altitude, whilst he is above the horizon in any oblique sphere, by reducing it to the finding of the curve surface of a cylindric *Ungula* or hoof, or of a given part thereof: Now this problem is not of that difficulty, as appears at first sight; for in Fig. 5. let the cylinder ABCD be cut obliquely by the ellipse BKDI, and by the centre thereof H, describe the circle IKLM; I say the curve surface IKLB is equal to the rectangle of IK and BL, or of HK, and 2BL or BC; and if there be supposed another circle, as NQPO, cutting the same ellipse in the points P, Q; draw PS, QR parallel to the axis of the cylinder, till they meet the aforesaid circle IKL*m* in the points R, S,

R, S, and draw the lines R T S, Q V P biſſected in T and V; then is the curve ſurface R *m* S Q D P equal to the rectangle of B L or *m* D and R S, or of 2 B L or A D and S T or U P; and the curve ſurface Q N P D is equal to R S × *m* D — the arch R *m* S × S P, or the arch M S × 2 S P; or it is equal to the ſurface R *m* S Q D P, ſubſtracting the ſurface R *m* S Q N P; ſo likewiſe the curve ſurface Q B P O is equal to the ſum of the ſurface R *m* S Q O P, or the arch L S × 2 S P: This is very eaſily demonſtrated from the conſideration, that the cylindrical ſurface I K L B is to the inſcribed ſpherical ſurface I K L E, either in the whole, or in its analogous parts, as the tangent B L is to the arch E L, and from the demonſtrations of *Archimedes*, *de Sphæra & Cylindro l.* 1. *Prop.* 30, and 37, 39.

Now to reduce our caſe of the ſum of all the ſines of the ſun's altitude in a given declination and latitude to the aforeſaid problem, let us conſider Fig. 6. Plate II. which is the *Analemma* projected on the plane of the meridian; Z the *Zenith*; P the *Pole*; H H the horizon; æ æ the *Equator*; ♋ ♋, ♑ ♑ the two *Tropics*; ♋ I the ſine of the meridian altitude in ♋, and erect ♋ 1 equal thereto perpendicular to the *Tropic*, and draw the line T 1 interſecting the horizon in T, and the hour-circle of 6 in the point 4, and 6 4 will be equal to 6 R, or to the ſine of the altitude at 6; and the ſame holds for any other point in the *Tropic*, erecting a perpendicular thereat, terminated by the line T 1; thro' the point 4 draw the line 4 5 7, parallel to the *Tropic*, and repreſenting a circle equal thereto; then the *Tropic* ♋ ♋ in Fig. 6. will anſwer to the circle N O P Q in Fig. 5; the circle 4 5 7 will anſwer the circle I K L M; T 4 1 will anſwer the elliptic ſegment Q I B K P; 6 R or 6 4 will anſwer to S P, and 5 1 B L, and the arch ♋ T to the arch L S, being the ſemidiurnal arch in that latitude and declination; the ſine whereof, tho' not expreſſed in Fig. 6. muſt be conceived as analogous to the line T S or V P Fig. 5.

The relation between theſe two figures being well underſtood, it will follow from what preceeds, that the ſum of the ſines of the meridian altitudes of the ſun in the two *Tropics* (and the like for any two oppoſite parallels) being multiplied by the ſine of the ſemidiurnal arch, will give an area analogous to the curve ſurface R *m* S Q D P; and thereto adding in ſummer, or ſuſtracting in winter, the product of the length of the ſemidiurnal arch, (taken according to *Van Ceulen*'s numbers) into the difference of the aboveſaid ſines of meridian altitude; the ſum in one caſe, and difference in the other, will be as the aggregate of all the ſines of the

the ſun's altitude, during his appearance above the horizon; and conſequently of all his heat or action on the plane of the horizon in the propoſed day: And this may alſo be extended to the parts of the ſame day; for if the aforeſaid ſum of the ſines of the meridian altitudes, be multiplied by half the ſum of the ſines of the ſun's horary diſtance from noon, when the times are before and after noon; or by half their difference, when both are on the ſame ſide of the meridian; and if the product of half the arch anſwerable to the propoſed interval of time into the difference of the ſines of meridian altitudes be added thereto in ſummer, or ſubſtracted therefrom in winter; the ſum in one caſe, and difference in the other, will be proportional to the whole action of the ſun during that ſpace of time: It may be objected, that the radius of the circle, on which the perpendiculars are erected, is taken always the ſame, whereas the parallels of declination are unequal; but to this it is anſwered, that the ſaid circular baſes ſhould not be analogous to the parallels, but to the times of revolution, which are equal in all of them: It may perhaps be uſeful to give an example of the computation of this rule; let the ſolſtitial heat in ♋ and ♈ be required at *London*, Lat. 51° 32′.

°	′			°	′
38	28	Co-lat.	Diff. aſcenſ.	30	11
23	30	Delin. of the ſun.	Eſtival ſemidiurn. arch	123	11
61	58	Sine =, 882674	Hybernal ſemidiurn. arch	56	49
14	58	Sine =, 258257	(Sine 638923		
		Sum 1,140931	Meaſure of the Eſtival arch	2,149955	
		Diff. 0,624417	——— Hybern. arch	0,991683	

Then 1,140931 in 0,836923 + 624417 in 2,149955 = 2,29734
And 1 0,140931 in 0,836923 — 624417 in 0,991683 = 0,33895

So that 2,29734 will be as the tropical ſummer-day's heat, and 0,33895 as the action of the ſun in the day of the winter ſolſtice: After this manner, the following table is computed for every 10th degree of latitude, to the equinoctial and tropical ſun, by which an eſtimate way be made of the intermediate degrees.

Lat.

Lat.	Sun in ♈ ♎	Sun in ♋	Sun in ♑
0	20000	18341	18341
10	19696	20290	15834
20	18794	21737	13166
30	17321	22651	10124
40	15321	23048	6944
50	12855	22991	3798
60	10000	22773	1075
70	6840	23543	000
80	3473	24673	000
90	0000	25055	000

Several corollaries arise from this rule; as, 1. That the equinoctial heat, when the sun becomes vertical, is as twice the square of radius, which may be proposed as a standard to compare with, in all other cases. 2. That under the equinoctial, the heat is as the sine of the sun's declination. 3. That in the frigid zones, when the sun sets not, the heat is as the circumference of a circle into the sine of the altitude at 6; and consequently, that in the same latitude, these aggregates of heat, are as the sines of the sun's declination; and in the same declination, as the sines of the latitudes, and generally they are as the sines of the latitudes into the sines of declination. 4. That the heat of the equinoctial day is every where as the co-sine of the latitude. 5. In all places, where the sun sets, the difference between the summer and winter heats, when the declinations are contrary, is equal to a circle into the sine of the altitude at 6 in the summer parallel, and consequently these differences are as the sines of latitude into the sines of declination. 6. From the table it appears, that the tropical sun, under the equinoctial, has of all others the least force; under the *Pole* it is greater than the heat of any other day whatsoever, being to that of the equinoctial, as 5 to 4. From the table and these corollaries we may have a general idea of the sum of all the actions of the sun for the whole year, and that part of heat that arises simply from the presence of the sun may be brought to a geometrical certainty; and if the like could be performed for cold, which is something else than the bare absence of the sun, as appears by many instances, we might hope to bring what relates to this part of meteorology to a perfect theory.

An

An Experiment on the Effects of the Air *on a tranſparent Liquor, applied to explain Changes of Colour in the Blood of reſpiring Animals; by Dr.* Slare. Phil. Tranſ. N° 204. p. 898.

PUT a quantity of freſh filings of copper in a phial, whoſe bottom is broad and even, and then pour on them an urinous ſpirit, either of ſal-armoniac, or of urine itſelf, not made with quick-lime; the glaſs is not to be filled much above half, and then it muſt preſently be ſo cloſely ſtopped, that no air be admitted; for an error in one circumference, will marr the whole experiment: In making the experiment, you will obſerve, for four, five, or ſix days the tincture becoming deeper and deeper, and then it will be at a ſtand for two or three days, more or leſs, and afterwards it will gradually decline, until it become quite pale, and void of all colour; when it is in this ſtate, the eaſieſt way of performing the experiment, is to decant this clear ſpirit into a glaſs, ſo as to leave all the filings behind, which will ſhew that the filings did not give this tincture a-new, but that it is owing to the influence of the air; but in caſe you are furniſhed with an air-pump, and can pour off this pale liquor *in Vacuo*, and there ſtop it up cloſe, you may then preſerve it as long as you pleaſe, and exhibit it to advantage; you may alſo obſerve, that as ſoon as you admit the air, the upper ſurface becomes immediately firſt tinged, and ſo the tincture deſcends deeper and deeper, until it has penetrated the whole; and this it does the ſooner if the glaſs be wide, and the liquor by conſequence have a larger ſurface; or if you pour it out of one glaſs into another, the air makes a more ſudden change of the whole: That liquors ſhould loſe their tinctures is not to be wondered at; for even ink itſelf, by ſtanding ſtill, will loſe much of its tincture, and ſo do the tinctures of many minerals; tincture of ſulphur, and of ſalt of tartar will loſe their colours, and many vegetables are not long to be preſerved, but grow turbid; ſome becoming pale and colourleſs, leave their *Menſtrua*, and precipitate to the bottom, and are not eaſily, if ever recovered: In this experiment we have ſome things very uncommon; *viz.* that a deeply tinged liquor ſhould grow pale and colourleſs in a few days, without any admiſſion of air, or any other ingredients to diſturb it, or to cauſe any diſcernible precipitation or ſeparation, and that upon the re-admiſſion of the air, the liquor ſhould recover its former blue tincture. This influence of the air in this experiment, made Dr. *Slare* apply it to the great change, that is made upon blood; for it is obvious to every body, that

there is a great difference in colour between the venal and arterial blood; the former, as ſoon as it is let out of the vein, is of a dark colour, and muſt be expoſed to the air for ſome time before it obtains a florid red, and that only in the ſurface contiguous to the air: The obſervation is certain and unerring, that the venal blood, as it paſſes the right ventricle at its entrance into the lungs, is of a very opake and blackiſh complexion, and that in its paſſage thro' the lungs, before it reaches the left auricle, it is changed into a very florid and bright red; and it has been often obſerved, that perſons that have vomited blood, upon a rupture of ſome capillary veſſels of the lungs, have diſcharged a very frothy blood, and at the ſame time of a bright ſcarlet red; its being frothy argued an admixture of air, and its being red was owing to the tinging quality of the air; to expect that this change ſhould be made in the heart by any local ferment, or vital flame would be fruitleſs, becauſe this change is wrought, before its arrival thither, and becauſe the ſtructure of the heart denotes it to be principally made for projecting the blood in order to a circulation thro' thoſe various arteries which are branched from the heart; if we conſider the ſtructure of the lungs, we ſhall ſoon diſcover them to be a pneumatic engine principally deſigned for taking in air, and that in great quantities; it is true, we may call the lungs a contexture of veins, arteries, nerves, lymphæducts, *&c.* but we ſhall find the greater bulk of them to be veſicular, which ſeems to be a continuation of the wind-pipe, divided and ſubdivided into many branches, and theſe ſtill ſpun out into ſmaller and ſmaller pipes, all of them hollow; and the farther they run, the thinner their ſides do grow, which, upon inſpiration do ſwell and grow round, and upon expiration become flaccid, and abate ſomething of that figure; the ſanguiferous veſſels are divaricated thro' all the lobes of the lungs, and very cloſely accompany each *Veſicula*, in order to receive ſome conſiderable benefit from it, and this appears to the eye; for in an inſtant, a dark and foul blood is changed into a bright florid red colour: Thus the very ſtructure of the lungs, the change of colour both in the blood and in our experiment, the one from a dark opake colour to a noble ſcarlet, the other from a pale or colourleſs liquor to a rich ultramarine blue, do all ſhew that this alteration is owing to the air; and Dr. *Slare* is of opinion, that hence ariſe the great fermentations of the blood, the cauſe of the motions and actions of the muſcles; and that the animal ſpirits themſelves, thoſe great ſprings of motion, derive their energy and power, if not nature, from hence.

Corol-

Corollary 1. The air abounds in volatile ſalts, but that they muſt be called nitrous ſalts, has been ſcarcely doubted of, tho' this experiment and ſome others do contradict it; for nitrous ſalts ſeem not to have any property of volatile ſalt, nitre being of ſo fixed a nature, that it will continue melted in a very ſtrong fire, with ſcarce any evaporation; but if you put into it charcoal, or brimſtone, or give it an accenſion, you may obtain a great quantity of fixed ſalt, ſo that gold ſeems not to be of a more fixed nature.

Cor. 2. A ſtandard of volatile ſalts ſhould be ſettled, and Dr. *Slare* could think of none better than water; that ſalt, which in diſtillation is more fixed than water, ſhould not be reckoned amongſt volatile ſalts; this ſtandard will be juſtified by good meaſures, grounded on experience; for all ſalts, that are truely volatile, are really lighter than water, that is, in a chemical ſenſe, do with a leſs degree of heat ſublime in our glaſſes, or come over the helm, than water does; this is juſtified in the volatile ſalt of amber, erroneouſly ſo called; for it does not come up to the ſtandard of volatility, and is really no volatile ſalt, as will be made appear, if you take this ſuppoſed volatile ſalt, and diſtil it in a retort, or head and body, with common water, the water will aſcend in ſuch a degree of fire, where the ſalt will not; for you muſt encreaſe your fire conſiderably, to make it riſe after the water is evaporated, and left the dry ſalt at bottom; this made the Doctor enquire farther into the properties of this ſalt, which did not at all correſpond with volatile ſalts, (for all true volatile ſalts are alcali's) but on the contrary, would ferment with them, and quite deſtroy the property of true volatile ſalts, by bringing them to a dull inſipid ſalt, which ſome call *Sal Neutrum*; and alſo by fixing their volatile nature, quite deſtroy their ſpirituous and ſtimulating ſmell, by virtue of which, they have been always deſervedly eſteemed ſuch excellent cephalic medicines; therefore, examining this ſalt yet a little farther, you will plainly prove it to be an acid, that corrodes iron, turns ſyrup of july-flowers green, deſtroys the tincture of *Lignum Nephriticum*, and does not ferment with common acids; ſo that it plainly belongs to the tribe of acids, and ſhould be ſtruck out of the catalogue of volatile ſalts, and perhaps out of the number of ſpecific cephalics, and rather be degraded amongſt the diuretics, and even in that rank to have but an inferior ſtation; for it ſeems to be but a dull medicine, and more valuable for its price than great virtue, eſpecially, if quite diveſted of all its oil, in which the great cephalic and cordial virtues muſt needs be owned to conſiſt.

Cor. 3. Volatile ſalts are very powerful in extracting tinctures, and particularly in heightening thoſe colours, which are diſpoſed to be red; for tho' ſpirit of wine be a very catholic *Menſtruum*, and draws a very deep tincture of cochineel, yet it has been often obſerved, that if we put to this tincture, when higheſt, a ſmall proportion of volatile ſalt, it will be advanced to a great, even to a double degree; and thus Dr. *Slare* obſerved it to heighten the colour of arterial blood; and which is very curious, if you diſſolve it in your blood, whilſt bleeding at a vein, that blood will become very florid, and like the arterial; therefore, ſince nitrous ſalts produce none of theſe tinging effects, this corollary ſeems much to favour the notion, that the effects of the air on the blood, may be due to ſuch ſalts as are of a volatile alcaliſate nature.

Cor. 4. Contagious diſeaſes are communicated by the air in inſpiration, which ſeems more probable than by the air we take in with our food, becauſe of the ſmallneſs of the quantity, if compared with what we take in by the lungs.

The Preſſure of Water *in ſeveral* Depths; *and a* Well *that flows and ebbs; by Dr.* Oliver. Phil. Tranſ. N° 204. p. 908.

IN the bay of *Biſcay*, in a hundred fathoms of water, a quart glaſs-bottle, ſtopped with a large cork, and afterwards tied down with a ſtrong packthread, was faſtened to a rope, and with a lead at the end ſunk to the bottom of the ſea; upon drawing it up again, the cork was found quite preſſed thro' the neck of the bottle into its cavity, and the bottle full of ſalt ſea-water; the experiment was repeated with another bottle and cork in the ſame manner as before, but the cork not proving ſound, the ſea-water ſoaked thro' it, and the bottle was half full of water; ſo the cork remained in the mouth of the bottle, without being preſſed down at all; the experiment was repeated a third time in ninety fathoms of water, with a very ſound cork, and much larger than the mouth of the bottle, for it was forced down with a hammer as far as it would go, leaving about an inch of the cork above the mouth of the bottle, and tied down as before, but it ſucceeded not ſo well as at firſt, tho' the cork was now preſſed down into the neck, and became level with the mouth of the bottle.

Dr. *Oliver* went about a mile into the country to ſee a well much talked of in theſe parts, called *Lay-well*; it is about ſix foot long, five broad and near ſix inches deep; it ebbs and flows

ſeveral

PLATE. III.

several times in an hour, and that visibly enough; for from high water to low water-mark he found it somewhat more than five inches; and tho' when once it began to flow, it performed its flux and reflux in little more than a minute's time, yet it was observed to stand at its lowest ebb sometimes two or three minutes; so that it ebbed and flowed by a watch about 16 times in an hour, and sometimes, as he had been told, twenty; as soon as the water in the well began to rise, he observed a great many bubbles ascend from the bottom, but when the water began to fall, the bubbling ceased immediately; this ebbing and flowing is observed to be very constant both in winter and summer; and it does not seem to receive any increase by rain; it does not appear to have any communication with the sea, nor is its water brackish; the whole adjacent country is very hilly all along the coast, insomuch that from *Brixam* to the top of the hill is about a mile and a half; the well is about half way up the hill, which hereabouts is somewhat uneven and rugged, it issues out at a small descent, yet considerably higher than the surface of the sea; the water does not seem to be impregnated with any mineral; its taste is very soft and pleasant, without any manner of roughness; the country people use it in fevers, as their ordinary diet-drink, with good success.

The true Cortex Winteranus; *by Dr.* Hans Sloane. Phil. Transf. N° 204. p. 922.

CAPT. *Winter* one of the commanders of a ship which sailed round the world with Sir *Francis Drake*, brought into *England* from the streights of *Magellan* an aromatic bark, which had been very beneficial to those of his ship, both used instead of other spices with their meat, and as a very powerful medicine against the scurvy; *Clusius* in his *Exotics l.* 4. *c.* 1. *p.* 75. gives a figure and description of it, as he had it from some that came over in that ship, calling it *Cortex Winteranus*, from the commander of the ship, and the tree itself, *Magellanica Aromatica arbor ib. p.* 77. Dr. *Sloane* thinks he cannot reduce it to any of our species of plants, so well as to the *Periclymenum*, and therefore he calls it, tho' it differ in many things from the honeysuckle, *Periclymenum rectum, foliis laurinis, cortice acri aromatico:* This tree rises to be taller and larger than an apple-tree, spreading very much both in root and branches; the twigs have on them leaves of a light-green colour on their upper side, standing on foot-stalks half an inch long, the leaves themselves are an inch and a half in length, and an inch broad in the middle, where

where broadeſt, whence they decreaſe to both extremities, which end blunt; the flowers ſtand on footſtalks ¾ of an inch long, with two, three or more of them together, ſomething like thoſe of the *Periclymenum*; each of them are milk-white, pentapetalous, and they ſmell like jaſmin, to which ſucceeds an oval berry, conſiſting of two, three or more *acini* or ſmall berries, ſtanding together on the ſame common footſtalk, of a light-green colour, with ſome black ſpots, and in theſe berries are contained ſeveral black aromatic ſeeds, ſomething like the ſtones in grapes: It grows very plentifully in the middle of the ſtreights of *Magellan*; Fig. 1. Plate IV. repreſents the leaves and flowers on the twig, Fig. 2. its ſeeds: Half a dram of the bark boiled with other carminative ſeeds ſweats and relieves ſcorbutic patients; it has alſo proved an antidote againſt a poiſonous ſort of ſeal, called a ſea-lion, frequent in thoſe parts: The bark ſold in the ſhops under the name of *Cortex Winteranus*, Dr. *Sloane* obſerves is not the true *Cortex Winteranus*; they grow on different trees, in different countries, and their appearance is very different; yet are they ſo like in taſte, that he thinks they may be uſed as *Succedaneums* to each other.

A Continuation of Mr. J. Clayton's *Account of* Virginia. Phil. Tranſ. N° 205. p. 941.

WHEN you make the *Capes* of *Virginia*, you may obſerve it to be low land, ſo that at ſome diſtance, the trees appear, as if they grew in the water, and as you approach nearer, they ſeem to emerge out of it; for a hundred miles up the country, there are few ſtones to be found, only in ſome places, rocks of iron-ore appear, and yet no waters are to be found that turn purple with galls; providence hath ſupplied the common uſe of ſtones, by making the roads very good, ſo that they ride their horſes without ſhoeing them, and they are ſeldom beaten in their feet; for the country and climate being dry, their hoofs are much harder than thoſe of our horſes in *England:* In ſome places for ſeveral miles together, the earth is intermixed with oiſter-ſhells, and that to the depth of ſeveral yards; in ſeveral places theſe ſhells are much cloſer, and being petrified ſeem to make a vein of a rock; and ſome of theſe veins are about 3 or 4 yards thick, and as hard as free-ſtone; of theſe rocks of oiſter-ſhells, which are not ſo much petrified, they burn and make all their lime; in the looſer banks of ſhells and earth, there are often found perfect teeth petrified, ſome of which were two or three inches long, and above an inch broad; the part, that one might ſuppoſe to grow out

out of the jaw, was poliſhed, and almoſt as black as jet; the back-bones and ribs of whales have been dug ſeveral miles up the country: The ſoil in general is ſandy, and different ſoils are appropriated to the ſeveral ſorts of tobacco; for there is not only the two diſtinct ſorts of ſweet ſcented, and *Aranoko* tobacco, but of each of theſe there are ſeveral ſorts very different; the ſame ſort of ſeed in different earths will produce tobacco very different as to goodneſs; the richer the ground, the better it is for *Aranoko* tobacco, whoſe ſcent is not much minded, their only aim being to have it ſpecious, large and to procure it a bright kite's foot colour: Mr. *Clayton* thinks tobacco is a plant abounding in nitro-ſulphureous particles; for the planters try the goodneſs of their ſeed by caſting a little thereof into the fire, if it be good, it will ſparkle like gun-powder, as will likewiſe the ſtalks of tobacco leaves, and perhaps it has ſomething analogous to the narcotic ſulphur of *Venus*, which the Chemiſts ſo induſtriouſly labour after; the oil of tobacco hath wonderful effects in curing of old inveterate ſores and ſcrophulous ſwellings; the goodneſs of tobacco conſiſts in the volatility of its nitre; and hence the ſandy grounds that are moſt impregnated therewith, and whoſe nitrous ſalt is moſt volatile, yield tobacco's of the richeſt ſcent; whereas, in tobacco of ſtiff grounds, the ſalts ſeem more fixed and locked up in the oil, ſo that whilſt new, it is very heady and ſtrong, and requires ſome time for its ſalts to free themſelves and become volatile, which it diſcovers by its urinous ſmell; the cloſer the compoſition of the leaf, the better is the tobacco, and you may gueſs at the goodneſs of tobacco, upon weighing the hogs-heads; for if an equal care be taken in the packing of them, the beſt tobacco will weigh the heavieſt; the ſweet-ſcented tobacco, which grows on ſandy land, is beſt for ſmoaking, whilſt it is new, or only two or three years old; but if you keep the ſtiff land tobacco, which is generally a tobacco of great ſubſtance, five or ſix years, it will by much exceed the former: The planters differ in their judgments about the time of planting, or pitching their crops; ſome are for pitching very early, others late, without any diſtinction of the nature of the ſoils; in ſandy grounds early planting is not ſo neceſſary; for the looſeneſs of the earth, and the kindlineſs of the ſoil, and the ſand retaining the heat, make the plants grow faſter; but in ſtiff ſoils, if the crops be not early pitched, ſo as, during the ſeaſon of rains, it have got conſiderable roots, and ſhot them ſome depth, if early droughts come on, it ſo binds the land, that the roots never ſpread or ſhoot deeper, or farther than the hill they are planted in; for they plant them

as

as we do cabbages, raiſing hills to ſet every plant in, about the bigneſs of an ordinary mole-hill: Tobacco is ſubject to ſeveral accidents and diſtempers, as the worm, the fly, firing to turn, as they call it, *Frenchmen*, and the like; the ſeed of tobacco is very ſmall, and conſequently ſo is the plant at firſt, now if gleamy weather happen at that time, it breeds a ſmall fly, which conſumes the plume of the plant; what they call *firing* is, when plants are of ſmall ſubſtance, as when, upon a very wet and cold ſeaſon, very hot weather ſuddenly enſues, the leaves turn brown and dry to duſt; they call thoſe plants *Frenchmen*, whoſe leaves do not ſpread and grow large, but rather ſpire upwards and grow tall; looſe and ſandy ſoils are more ſubject to them than ſtiff land.

A farther Account of Virginia; *by Mr.* Clayton. Phil. Tranſ. N° 206. p. 978.

Virginia in general is a very fertile ſoil, far ſurpaſſing *England*; for *Engliſh* wheat (as they call it, to diſtinguiſh it from maize, commonly called *Virginia* wheat) yields generally between fifteen and thirty fold, with once only plowing; whereas it is a good crop in *England*, that yields above eight fold, after all their toil and labour; and they are the moſt barren parts that are cultivated, the richer vales being left untilled for want of draining them; ſo that the richeſt meadow lands, which is one third of the country, is boggy, in which they loſe a great many of their cattle, eſpecially in the beginning of the ſpring, when the cattle are weak, and venture too far after young graſs; whereas they might be greatly improved, for *Virginia* is generally ſandy with a ſhallow ſoil: To prevent the rankneſs of their tobacco, they top it, that is, take away the little top-bud, when the plant has put forth as many leaves as they think the richneſs of the ſoil will bring to perfection, but generally when it has ſhot forth four or ſix leaves; and when the top-bud is cut, it puts forth no more leaves, but ſide-branches, which they call ſuckers, and which they are always careful to take away, that they may not empoveriſh the leaves.

As to the birds of this country, there are three ſorts of eagles; the largeſt is what they call the grey eagle, being much of the colour of our kite or glade; the ſecond is the bald eagle, for the body and part of the neck and head are covered with a white ſort of down, whereby it looks very bald, whence the name; the third is the black eagle, reſembling moſt of all the *Engliſh* eagle; they generally build their neſts on the top of ſome tall old tree,

ſtripped

ſtripped of its boughs, and near a river ſide, and the people uſually fell the tree, when they take the young; when this eagle obſerves, that the fiſhing-hawk hath ſtruck a fiſh, he takes wing immediately, and it is ſometimes very pleaſant to ſee the flight; for when the fiſhing-hawk perceives himſelf purſued, he ſcreams and makes a terrible noiſe, till at length he drops the fiſh to make his own eſcape, which the eagle frequently catches before it reach the earth or water; theſe eagles kill young lambs, pigs, *&c.* The fiſhing-hawk is entirely a ſpecies of a king's-fiſher, and much of the ſhape and colour of that bird, tho' not quite ſo curiouſly feathered; but full as large, or larger than our jay; it has a large crop; there is alſo a ſmall king's-fiſher, much the ſame in every reſpect as ours; there are brown and white owls, about as large as a gooſe, which often kill hens and poultry in the night; the white owl is a very delicate feathered bird, all the feathers on the breaſt and back being ſnow-white, and tipped with a jet-black; there is beſides a barn owl much like ours, and a ſmall ſort of ſcritch-owl: By diſſection it appears that all flat-billed birds, that grope for their food, have three pair of nerves, that reach down to their bills, by which they are enabled to diſtinguiſh accurately what is proper for food and what not; a duck hath theſe nerves larger than geeſe, or any other fowl, and therefore they quaſer and grope out their meat the moſt; but Mr. *Clayton* had alſo obſerved in a rook two nerves coming down between the eyes into the upper bill, but conſiderably ſmaller than any of the three pair of nerves in the bills of ducks, and larger than the nerves in any other round-billed birds; and it is remarkable, that theſe birds ſeem to grope for their food in cow-dung, and the like, more than any other round-billed birds; he afterwards found the like nerves coming down between the eyes, in ſeveral round-billed birds, but ſo very ſmall, that had he not ſeen them firſt in a rook, he ſhould ſcarcely had made the diſcovery; in the lower bill there are nerves, which have much the ſame ſituation with the flat-billed birds, but very ſmall, and ſcarce diſcernible, unleſs to the cautious and curious: The night-raven, called by ſome the *Virginia* bat, is about the bigneſs of a cuckow, feathered like them, but very ſhort, and with ſhort-leggs, which are not diſcernible when it flies, which is only in the evening, like our night-raven: There is a large ſort of ravenous bird, that feeds on carrion, almoſt as big as an eagle, called a turky-buſtard, its feathers are of a duſkiſh black, it hath red gills, reſembling thoſe of a turkey, whence its name; it is rather of the kite-kind than of the ſpecies of *Engliſh* turkey-buſtard, for it hovers on the

wing, and is carnivorous like them; its fat, diſſolved into an oil, is recommended much in old aches and iſchiatic pains: The *Pica Glandaria*, or jay, is much leſs than our *Engliſh* jay, and of a different colour; for it is all blue, whereas ours is brown; its wings are as curiouſly marbled as thoſe of ours are, it has both the ſame cry and ſudden jetting motion: There is great variety and curioſity in the wood-peckers; they have one ſpecies as big as our magpy, with blackiſh brown feathers, and a large ſcarlet tuft on the top of the head; there are four or five ſorts of wood-peckers more, variegated with green, yellow and red heads, others are ſpotted red and white in a very beautiful manner: Their wild turkies are extreme large, ſome of which are ſaid to weigh between 50 and 60 pound weight; their legs are very long, and they run prodigiouſly faſt; their feathers are of a blackiſh ſhining colour, which, in the ſun, ſhine like a dove's neck, and are very ſpecious: Their hens and cocks are for the moſt part without tails and rumps; and our *Engliſh* fowl, after being ſome time there, have their rumps rotten off; the rumps in birds are furniſhed with a pair of glands, which contain a ſort of juice for varniſhing their feathers: Their partridges are ſmaller than ours, and keep in covies as ours do; their fleſh is very white, and much exceeds ours: Their turtle-doves are of a duſkiſh blue colour, ſmaller than our common pigeon, with long tails: Their mocking-birds may be compared to our finging-thruſhes, being much of the ſame bigneſs; there are two ſorts of them, the grey and the red; the former have feathers much of the colour of our grey plovers, with white in the wings like a magpy; theſe have the ſofter note by far, and will imitate, in their ſinging, the notes of all other birds, and they are accounted the fineſt ſinging-birds in the world; it is a briſk and bold bird, and yet ſeems to be of a very tender conſtitution, neither ſinging in winter, nor in the middle of ſummer, and with much difficulty are any of them brought to live in *England*: By diſſection it appears that the ears of birds differ much from thoſe of men or beaſts; there is almoſt a direct paſſage from one ear to the other in birds; but what is more remarkable they have no *Cochlea*, but in lieu thereof a ſmall winding paſſage, which opens into a large cavity, that runs between two ſculls, and paſſes all round the head, the upper ſcull is ſupported by a great number of ſmall thread-like pillars or fibres; and this paſſage between the ſculls is much larger in ſinging birds than in others; a mole has an ear much like that of a bird: The red mocking-bird is of a duſkiſh red, or rather brown, it ſings very well, but has not ſo ſoft a note

a note as the grey mocking-bird: There are two ſorts of the *Virginia* nightingales, or red birds, the one has a tuft on the head, the other is ſmooth feathered; the cocks of both ſpecies are of a pure ſcarlet, the hens of a duſkiſh red: There is a bird very injurious to corn, called a black-bird, being as black as a crow, only ſome of them have ſcarlet feathers in the pinions of their wings; it ſeems to be a ſort of ſtarling; for they cry like them, but do not ſing, and are much of the ſame bigneſs; their fleſh is blackiſh and they reſort in flocks together: They have larks differing in nothing from our common larks, and another bird, which they call a lark, that is much larger, and as big as a ſtarling, it has a ſoft note, and feeds on the ground: Their martins are like ours, only larger, and they build after the ſame manner; their ſwallows differ but little from ours: They have a bird, called a blue-bird, of a curious azure colour, and about the bigneſs of a chaffinch; they have ſeveral ſorts of gold-finches variegated with red, orange and yellow feathers, very ſpecious and beautiful; Their ſparrows differ not much from the *Engliſh*, but build not in the eaves of houſes: The ſnow-bird, which ſeems to be much the ſame with our hedge-ſparrow, is ſo denominated, becauſe it ſeldom appears about houſes, but againſt ſnow, and very cold weather: The humming-bird feeds on the honey of flowers, ſome of them have been kept alive and fed with water and ſugar; they are by far the ſmalleſt of birds, have long bills, and curiouſly coloured feathers, but differ much in colour: There are 3 or 4 ſeveral ſorts of herons, and one larger than the *Engliſh*, and feathered much like a *Spaniſh* gooſe; there is another ſpecies of them which come only in ſummer, they are milk-white with very beautiful red legs: Their bitterns are ſmaller than thoſe in *England*; their curlews are ſomething leſs than the *Engliſh*, tho' larger than a wimbrel; the ſand-piper reſembles much the *Engliſh*; they have two ſorts of ſnipes, one reſembling ours, the other ſmaller; the tewits are ſmaller than the *Engliſh*, but without thoſe long tufts, exactly reſembling a young one, that begins to fly; they have great numbers of wild-ſwan, wild-geeſe, brent-geeſe, wild-duck, teal, widgeon, ſheldrakes, *&c.*

An Earthquake *in* Sicily; *by* Vincentius Bonajutus. Phil. Tranſ. N° 207. p. 2.

THE continual fiery eruptions of *Ætna*, of which the firſt we have any account, happened 500 years before the deſtruction of *Troy*, according to *Diodorus Siculus*, have been taken for the moſt probable cauſes of the horrible ſhocks, that

from time to time have laid waſte the iſland of *Sicily*: On the 10th of *January*, 1693, there happened an earthquake, whoſe motion was of that ſort, which *Ariſtotle* and *Pliny* call the firſt ſpecies, and which they compare to the ſhaking fit of an ague, cauſing ſuch a motion as ſhakes the earth from ſide to ſide; in this ſhock, almoſt all the edifices in the country were thrown down, of which ſome were very high and ſtrong built towers; a great part of the city of *Catanea*, with many others, was demoliſhed, and a great many buildings in *Val di Noto*; *Syracuſe* was alſo much ſhattered, but not ruined; this earthquake was not preceeded by any darkneſs in the air, but by an agreeable, ſerene and warm ſeaſon; which was the more obſervable, as being unuſual at that time of the year: The preceeding evening there was a great flame or light obſerved at about the diſtance of an *Italian* mile, and ſo bright, that it was taken for a real fire made by ſome of the country people, and it ſeemed to the ſpectators ſtill to keep at the ſame diſtance, tho' they went directly towards it; whilſt they were obſerving this appearance, the earth-quake began, upon which the light quite vaniſhed, and the waves of the ſea, which, before the ſhock, beat gently on the ſhore, began now to make a dreadful noiſe; the next day, the air was overſhadowed with darkneſs, and tinged with a deep yellow, and the darkened ſun ſtruck the minds of the ſpectators with the melancholy preſage of the approaching earthquake, which was the ſecond and happened on the 11th of *January*, and laſted about four minutes; it was much like the ſecond ſort, which *Ariſtotle* and *Pliny* call a pulſe or ſtroke, from its reſemblance to the beating of an artery, and by *Poſſidonius* in *Seneca* is repreſented by the name of vibrations, it being a perpendicular lifting up of the earth: This ſhock affected *Sicily* all over, and its impulſe was ſo vehement and powerful that not only many cities and ſeveral parts of the kingdom of *Naples*, but alſo the iſland of *Malta* ſhared in its fury; it was impoſſible for one to keep on his legs, and even thoſe, who lay along on the ground, were toſſed from ſide to ſide, as if on a rolling billow: In open places the ſea ſunk down conſiderably, and in the ſame proportion in the ports and incloſed bays, and the water bubbled up all along the ſhore; the earth opened in ſeveral places in very long clefts, ſome an hand's breadth, others half a palm, and others like great gulfs; from thoſe openings in the vallies there iſſued out ſuch a quantity of water as overflowed a great ſpace of ground, which to thoſe that were near it, had a ſenſible ſulphureous ſmell: In the plain of *Catanea*, from one of thoſe narrow but very long clefts, and about

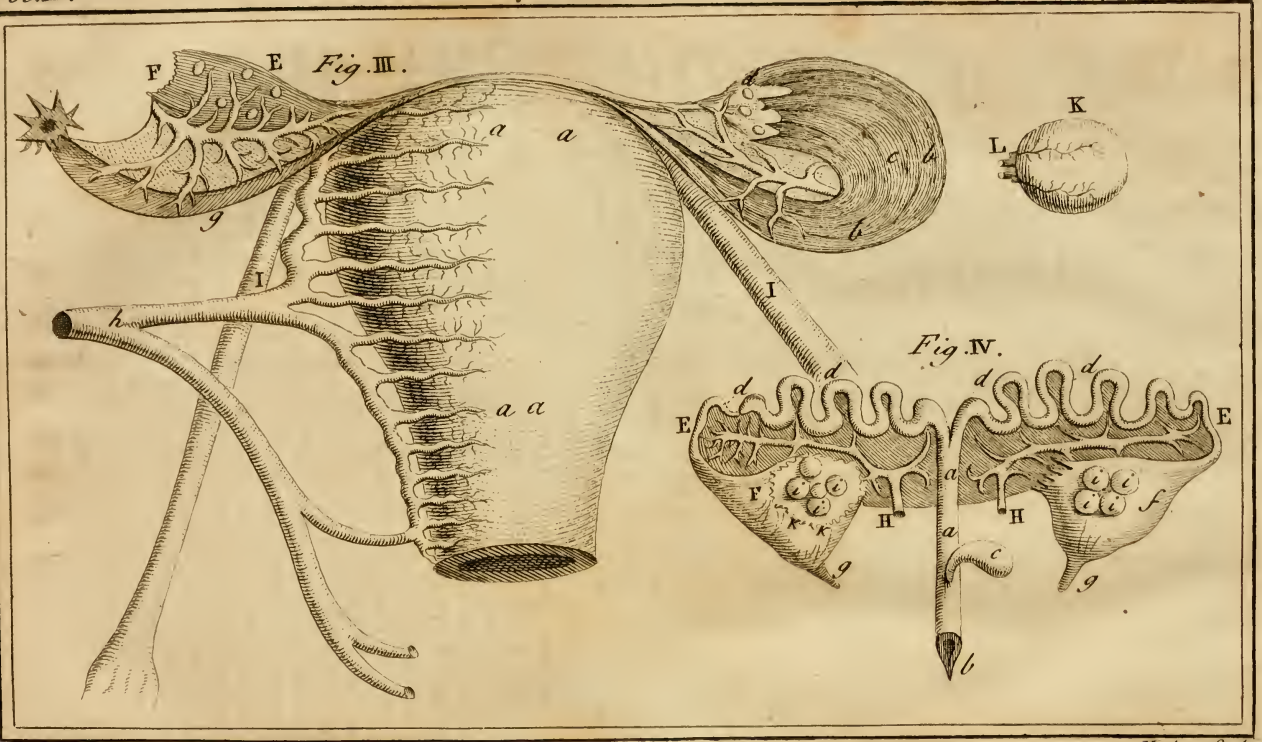
about four miles off the ſea, the water was thrown out altogether as ſalt as that of the ſea; in the city of *Noto* a ſtreet, half a mile in length, and built of ſtone, was ſettled into the ground, and hung quite on one ſide like an inclining wall; and in another ſtreet before the *Aſſent del Durbo* was an opening big enough to ſwallow a man and horſe; there were every where great rocks looſened and thrown down from the mountains; and in the country of *Sortino*, a great number periſhed in their houſes, which were beaten down by the rocks in their rolling down the hills: At *Syracuſe* and other places near the ſea, the water in many wells, which at firſt were ſalt, became freſh and fit to drink; the fountain *Arethuſa* was ſo brackiſh for ſome months, that its water could not be uſed, but afterwards it became ſweeter, and its ſpring was encreaſed to near the double; in the city of *Termini* all the running waters were dried up, but the hot baths were augmented by a third part of what they were before the earthquake: In many plain and level places, very high walls leaped from their foundations above two paces, leaving that whole ſpace perfectly clear and free from rubbiſh, as if they had been taken up and carried off: A fountain in the very moment of the earthquake ejected its waters tinged of a blood-red for three hours, and then it dried up, leaving many holes in the mud at bottom, thro' which real aſhes were thrown out, and the next day the waters returned of the former quality, without the leaſt alteration: The ſouth winds blew very much, which ſtill have been impetuous in the moſt ſenſible earthquakes; and from the 11th of *January* to the 14th of *September* there were conſiderable and ſtrong ſouth winds, which were preceeded by a noiſe like a cannon at a great diſtance, ſometimes of a longer, and ſometimes of a ſhorter continuance: It has been obſerved that in leſs ſolid ground, ſuch as chalk, ſand, or looſe earth, the damage was incomparably greater than in rocky places; its effects on human bodies have been various, ſuch as fooliſhneſs, but not to any great degree, madneſs, dullneſs, ſottiſhneſs, hypochondriac, melancholic and choleric diſorders; fevers were very common, with continual tertian, and malignant ones, accompanied with *Deliria* and lethargies; the ſmall-pox made great havock amongſt children; and in ſhort no age or condition but had its ſhare in ſo univerſal a calamity.

An

An Egg *found in the* Tuba Fallopiana *of a Woman; by Mr.* Buffiere. Phil. Tranſ. N° 207. p. 11. *Tranſlated from the* French.

A Young woman, between 25 and 26 years of age, conceived a few days before her execution; upon opening her body, M. *Buffiere* found, that the left *Fallopian* tube was dilated towards its extremity in an extraordinary manner; the greateſt dilatation was more than an inch in diameter, and extended itſelf a little more than an inch and a half, tapering towards the *Matrix*; this part, thus dilated, was bent, and embraced almoſt the whole ovary, to whoſe membrane it adhered ſo cloſely, that it could not be ſeparated therefrom but by force; after ſeparation there iſſued out a limpid and unctuous liquor, which manifeſtly ſeem'd either to relax the membranes of the *Tuba*, in order to promote its dilatation for the eaſier diſcharge of the egg into the *Matrix*, or to anoint this paſſage, that the egg might have no difficulty in its way, and poſſibly this liquor might anſwer both purpoſes: M. *Buffiere* could obſerve nothing in the body of the *Tuba* which could produce this liquor, tho' it was thicker than ordinary, and this thickneſs was owing to the ſwelling of its fibres, which were as fleſhy as thoſe of ordinary muſcles, in order doubtleſs to give it a ſufficient degree of force and motion for expelling the egg, after it is detached from the ovary, and for conveying it into the *Uterus*; M. *Buffiere* therefore thinks, that this liquor, contained in the *Tuba*, comes from the ovary, and that the fibres and ſmall lymphatic veſſels and others, which are torn for opening a paſſage for the impregnated egg, ſuffer this liquor to run out, either for the firſt nouriſhment of the egg, or to promote its paſſage into the *Uterus*; what confirms this notion is, that in the females of animals, from whoſe ovary ſeveral eggs are detached at a time, this liquor is found in conſiderable quantities; and in a ſow, the *Tubæ*, on each ſide embracing the ovary, were found to contain between three or four ounces of this liquor, each: After the *Tuba* was ſeparated from the ovary, and the liquor run out, the egg came to view, it was of the bigneſs of a ſmall nut, and was ſurrounded with this liquor in the middle of the dilated cavity of the *Tuba*; three fourths of this egg were already out of the ovary, by the hole which it had made therein, ſo that it ſeemed to have no longer any connexion therewith; yet when he attempted to remove it, it was ſtill faſtened by a pedicle ſufficiently firm, thro' which the ſanguineous veſſels, which ſpread themſelves within-ſide, and upon the egg, did paſs; it is by theſe veſſels that the *Fœtus* receives

PLATE. IV.



receives the matter of its growth and nouriſhment, not only in the ovary, but alſo in the *Uterus*, this pedicle being that which is to form the *Placenta* (or is the *Placenta* itſelf already formed in the ovary) by faſtening itſelf to the body of the *Uterus*; it is alſo by this we are to conceive, that the ſeminal ſpirit of the male is conveyed into the body of the *Fœtus* in the egg, in order to give it motion and fecundity: There appeared yet no ſenſible change in the *Uterus*, except the great quantity of mucous matter it contained, which is very natural; the left *Tuba* was in its natural ſtate, as well as the ovary, excepting the aperture by which the egg of a former birth was diſcharged.

Fig. 3. Plate IV. repreſents the *Uterus*; *a a* is the body of the *Uterus*; *b b* the dilated *Tuba* embracing the ovary *d*; *c* the impregnated egg contained in the *Tuba*; E the left ovary; F the aperture by which the egg of a former *Fœtus* was diſcharged; *g* the left *Tuba*; *h* the hypogaſtric artery; I I the round ligaments; K the egg detached from the ovary; L the pedicle, by which it was ſtill connected to the ovary.

Fig. 4. repreſents the *Uterus* of a ſow; *a a* the *Vagina*; *b* the *Vulva*; *c* the bladder of urine; *d d d d* the *Cornea Uteri*; E E the *Tubæ Fallopianæ*; F F the extremities of the dilated *Tubæ* embracing the ovaries, and full of liquor; *g* the appendix of the *Tubæ*; H H the arteries of the *Uterus*; *i i i i* the eggs as they come out of the ovary; K K one of the *Tubæ* looſened from part of the ovary.

Obſervations on a Maid, *who died of an* Aſcites; *by Mr.* Turner. Phil. Tranſ. N° 207. p. 15.

TO prevent the too impetuous eruption of the contained liquor, in caſe inciſion had been preſently performed, a perforation was made in the moſt prominent part of the *Abdomen*, by a paracenteſis, whereby, thro' a ſmall *Cannula* there was extracted the quantity of three gallons; afterwards an inciſion was made between the navel and *Cartilago Enſiformis*, which was ſtill enlarged in proportion to the quantity emptied, till there was room for a quart pot to enter, with which there was drawn out 76 meaſured quarts (including the three gallons extracted before) of a ſubſaline and ſomewhat auſtere *Serum*, which amounted to the quantity of 19 gallons, beſides what was imbibed by the ſponges, which might be about two quarts more: After the drying up the reſidue of this liquor (which in colour and conſiſtence did ſomewhat reſemble water, wherein fleſh newly killed had been waſhed, except that it was of a ſomewhat deeper red,

red, and had a more craſs *Hypoſtaſis*) it was plainly ſeen, that this whole bulk of water was ſuſtained between the *Cutis* and *Peritonæum*, whereby there was made ſo great a compreſſion of the inteſtines, and other *Viſcera* to the *Vertebræ* of the loins and *Os Sacrum*, that it is ſurpriſing how there could be any protruſion of the excrements, ſince by the aboveſaid compreſſion the periſtaltic motion muſt be very ſlow, if any at all; and ſecondly, the *Muſculi Recti* of the *Abdomen*, which are ſaid to be ſubſervient to that neceſſary excretion, were not only at a very conſiderable diſtance, but even quite obliterated, or at leaſt not diſtinguiſhable from the *Panniculus Carnoſus*, or common integument of the body; when at the ſame time the outward covering or *Cutis* itſelf, notwithſtanding ſo extraordinary a dilatation, was full as thick as in a ſound body, and in ſome places much thicker; particularly in the hypogaſtric region, where the *Membrana Adipoſa* was obſerved to be above two inches thick, and ſeemed to be no other than a congeries of little bladders, each contained in its proper *Capſula*, and ſtuffed with a coagulated lymphatic juice: One would have thought that the blood in the abdominal veſſels had been ſtagnated for ſome time before, or at leaſt that its circulation was vitiated; for one might obſerve in ſeveral places it was extravaſated, and that it adhered in great clots to the membranes: The patient's thighs, legs, and feet were anaſarcous, and ſo extremely bloated with a watry humour, that one could bury three or four fingers in them; and yet her upper parts, as the neck, face, arms, and hands were ſo much emaciated, that ſhe ſeemed like a ſceleton: After dividing the *Peritonæum*, the firſt thing that ſhould have offered itſelf, is the caul, yet in this ſubject it was ſo entirely waſted, that the leaſt trace thereof did not remain; the inteſtines were not ſenſibly altered in any other reſpect than in their colour, which was ſomewhat pale, as if they had been ſeethed; and indeed, the bowels for the moſt part, as the ſtomach, *Pancreas*, liver, ſpleen, kidneys, *&c.* had the appearance of fleſh half boiled, and their blood abſorbed; for tho' none of them did ſwim in, or communicate with the *Serum*, yet the nearneſs of the ſuperincumbent liquids had polluted and tinged the external coats of the *Viſcera* with their preternatural as well as putrefactive heat: The inteſtines were all of them diſtended with *Flatus*'s, particularly the *Cæcum* to a conſiderable degree; in the *Colon* and *Rectum* the excrements were formed into little balls, and ſo hard as to take any impreſſion; the liver, which is ſaid to be principally affected in this diſtemper, was no more faulty than the reſt of the bowels; the whole body of the ſpleen adhered

adhered to the *Peritonæum*, but was eaſily ſeparable therefrom; the kidneys were free of any obſtructions; the bladder was empty; the ſtomach had nothing but wind in it; the diaphragm was forcibly impelled upwards into the cheſt, and its convex part bore hard againſt the lobes of the lungs, whoſe ſubſtance was much decayed, and looked like par-boiled fleſh; upon cutting open the heart, it did not yield the leaſt drop of water, or blood, no more than the other bowels.

A Woman Hydropical *in the external Coat of the* Uterus; *by Mr.* Turner. Phil. Tranſ. N° 207. p. 20.

A Woman, aged 44 and upwards, ſome time after ſhe was married, had conceived, as ſhe thought by ſome ſuppoſed ſymptoms of pregnancy, and at the expiration of the time of her account, her fancied pains came on, and ſhe thought herſelf very near her labour; her belly was grown very big, and had gradually encreaſed from the time of her imagined conception; at laſt, after more than three years from the time of her ſuppoſed pregnancy, ſhe removed into the air, where ſhe had not continued long before ſhe languiſhed and died: Upon making a crucial inciſion from the navel to the *Ilia* and *Os Pubis*; one of the diſſecters, cutting thro' the *Peritonæum*, accidently thruſt his knife too far, and immediately there iſſued out, with impetuoſity, a ſtream of a limpid *Serum* or *Lympha*, as clear as water, to the quantity of more than two gallons, incloſed in a thin tranſparent membrane, which was found to be the external coat of the *Uterus:* One of the great indications of this woman's pregnancy, was a flux of a whitiſh humour to her breaſts, which ſhe could ſqueeze out at pleaſure; ſhe had likewiſe laboured the greateſt part of the time under a ſuppreſſion of the *Menſes*.

A Child *bit by a* Mad-Dog; *by Mr.* J. Turner. Phil. Tranſ. N° 207. p. 24.

A Child, of about three years old, was bit on the *Maſſeter* muſcle by a mad dog; the wound was treated with digeſtives for ſome time, ſutures were forborn, tho' otherwiſe neceſſary, that the venom might be the more freely diſcharged; in a little time there was a diſcharge of a very laudable *Pus*, and the wound incarnated very faſt, without any inflammation; in about three weeks after this, the child was ſeized with a fever, a diſorderly pulſe, and palpitation of the heart; the enſuing night he grew delirious, and the ſucceeding day the malignity had made ſo virulent an impreſſion on the animal ſpirits, as excited very

ſtrong irritations in the members of the body; nor was the brain, and its parts, freed from the ſame morbid taint, which ſhewed itſelf in the unuſual diſtortion of the eyes, and an extraordinary fierceneſs in the whole viſage, continual watchings, and a conſtant trembling, with a repeated ſnatching up of the lower jaw, making ſigns as if he would have bit at any thing that was offered him; his voice had acquired a canine hoarſeneſs, and much reſembled the barking of a dog; he was beſides infeſted with the hickup, and a foaming at the mouth; and thus he continued for the moſt part of the day; upon preſenting a looking-glaſs before him, he was extremely diſordered thereat, throwing his head backwards with great violence, barking, and ſnapping at every thing near him; in the evening, notwithſtanding all the alexipharmics that were exhibited, he ſunk under thoſe cruel ſymptoms; he was not ſuffered to be opened; but the *Abdomen* was obſerved to be exceſſively inflated, his limbs convulſed, and the ſurface of the body was of a livid colour; the muſcles of the face were contracted into ſuch a form, as nearly repreſented a *Spaſmus Cynicus*.

Experiments made with Mr. Colbatch's Styptic; *by Mr.* Will. Cowper. Phil. Tranſ. N° 208. p. 42.

HAVING provided a large dog, an aperture was made thro' the common integuments of his *Abdomen*, from which the ſmall guts were extruded; after an inciſion made in one of them, according to its length, they were again reduced; the wound in the *Abdomen* being ſtitched up, a ſolution of *Colbatch*'s powder was applied; the dog continued without any ill ſymptoms, and became perfectly well in a few days after: The like experiment Mr. *Cowper* made on another dog, that alſo recovered without the application of any medicine.

The leg of a dog was amputated three inches above the *Patella*; the expence of blood from the arteries was great, which partly proceeded from the unaptneſs of the applications; but after two or three attempts, the flux of blood was ſtopped, and ſuch a bandage uſed, as was neceſſary only to keep on the dreſſings; the dog continued without any conſiderable flux of blood, and the next day he was found on his three legs.

The diſeaſed arm of a man, in St. *Bartholomew's Hoſpital*, was amputated above the elbow; but for above a quarter of an hour's time, many ſucceſsleſs applications of this ſtyptic were made, and at length a ſmall tent, dipped in the powder itſelf, was inſerted into the extremity of the bleeding artery, before the flux

flux of blood would admit the application of bandage; five hours after, a freſh flux of blood appeared, and a ſtrict bandage was applied: At the ſame time, a boy, about 12 or 14 years of age, had his leg alſo cut off below the knee, to whoſe ſtump divers ſucceſsleſs applications of this ſtyptic were alſo made, before it was bound up, and in leſs than an hour after, a freſh flux of blood happened, and ſtrict bandage was added: Some hours after theſe operations, both theſe patients ſuffered intolerable pain; in three days, the applications were taken off, and had any perſon, a ſtranger to what was done, ſeen the ſtumps, he would have ſuppoſed nothing leſs than an actual cautery had been applied, and have occaſioned ſuch large eſchars, and ſo frightful an appearance; which ſufficiently demonſtrated, that this vulnerary powder was a violent cauſtic.

Trials of ſtyptics have been commonly practiſed on the bodies of quadrupeds, to commend them to the publick; but it is not without cauſe, that pretenders to ſuch remedies have made choice of younger animals, as dogs and calves, *&c.* for that purpoſe; but ſince the only ſtandard of their uſe is their ſucceſs on human bodies, we ſhould make our experiments on thoſe animals, whoſe bulk and age bear a proportion to them; for nothing is more obvious in wounding the arteries of living animals, than that the protruſion of their blood bears a proportion to their bulk; and in diſſection, the arteries of a *Fœtus* are remarkably thinner than thoſe of an adult, and thoſe of aged perſons grow ſtill thicker, and frequently become cartilaginous, and at length entirely bony.

Swarms of Locuſts *in* Wales; *by Mr.* Edw. Lloyd. Phil. Tranſ. N° 208. p. 45.

GREAT ſwarms of locuſts were ſeen in *Wales*, they were firſt obſerved about the 20th of *October* 1693, in *Pembrokeſhire*, about the fields in *Marthery* pariſh: In *North Wales*, two vaſt ſwarms of them had been obſerved in the air, not far from *Dol-gelhen*, a market-town of *Merionydhſhire*, and about the ſame time that thoſe others of *Pembrokeſhire* had been taken notice of in the fields: They were of the ſame ſpecies with ſome *African* locuſts; and Mr. *Lloyd* calls this pilgrim-locuſt, *Locuſta erratica, alis Ichthyocollæ adinſtar pellucidis, reticulatis maculis conſperſis*; it is in length, from the head to the tips of the wings, 3 ¼ inches, and of a reddiſh colour all over, except the wings; the eyes were prominent, and very large, ſomewhat of the form and bigneſs of gromwell-ſeeds, of a reddiſh colour, elegantly

ſtreaked; the *Antennæ* were about the bigneſs of a hog's briſtle, and curiouſly geniculated; the firſt pair of legs were not quite an inch long, the ſecond were ſomewhat longer, and the third two inches and a quarter; theſe hinder legs were very beautiful, for the thighs were hexangular, and elegantly ſealed on the outſide, with a black liſt extended lengthwiſe thro' their middle; the ſhanks were of a lively red colour, adorned on the hinder part with two orders of ſmall ſharp prickles, placed alternately; the wings were about three inches long, reſembling very much thoſe of the larger *Libellæ*, or dragon-flies, but all over adorned (eſpecially the outer wings) with reticulated black ſpots: Mr. *Lloyd* ſees no reaſon to doubt, but that theſe are the very ſame ſpecies of locuſts, ſo famous in hiſtory for their wandring over, and depopulating whole countries.

To meaſure the Quantity of falling Rain; *by Mr.* Townley. Phil. Tranſ. N° 208. p. 51.

MR. *Townley* fixed a round tunnel of 12 inches diameter to a leaden pipe, which would admit of no water, but what came thro' the tunnel, by reaſon of a piece ſoldered to the tunnel itſelf, which went over the pipe, and ſerved alſo to fix it thereto, as well as keep out any wet, that in ſtormy weather might beat againſt the under part of the tunnel, which was ſo placed, that there was no building near it, that would give occaſion to ſuſpect that it did not receive its due proportion of rain that fell thro' the pipe, about nine yards perpendicularly, and then it was bent into a window near his chamber, under which convenient veſſels were placed to receive what fell into the tunnel; which he meaſured by a cylindrical glaſs, at a certain point, containing juſt a pound, or 12 ounces *Troy*, with diviſions for ſmaller parts alſo; by the help of this cylindrical glaſs, he kept an account of what rain fell, and generally twice or thrice a day; what rain he found in the receivers, if not more than made what was left in the cylindrical glaſs a full pound, he again left therein; but if it exceeded that quantity, he filled it juſt to the pound-point, which he threw away, and did the ſame with the remaining water, as often as it would allow, ſtill keeping an account, eſpecially of the pounds thrown away, and ſetting down the parts of a pound remaining in the glaſs; by the help of which latter, and the parts remaining at any time before, by numbering the pounds, and ſubſtracting the parts, at the end of one month ſuppoſe, from the pounds thrown away, and the parts remaining at the end of another, he found the quantity of rain fallen between theſe two times, and that in ſuch a manner

as

as to assure him, that he erred no more in the quantity of rain of another year, than by the mistake in the differences of the parts of a pound in the first and last observations; whereas should he still write down the rain that falls between two observations, he might be subject to make as great a mistake in every one of them, and consequently be much more uncertain of the quantity of rain fallen in many of those added together; besides, this addition is longer in performing and giving the quantity sought, than the method he made use of; and he subjoined the following particulars to shew how little trouble there is in this task.

Observations of the rain falling monthly for 15 years

	1677	78	79	80	81	82	83	84	85	86	Sum
Jan.	472	371	43	512	53	986	238	32	110	472	3289
Feb.	270	371	161	492	363	135	245	483	42	20	2582
March	245	250	202	413	235	237	305	87	185	572	2731
April	325	170	92	222	57	308	402	370	380	305	2631
May	313	581	105	188	69	315	353	97	201	437	2659
June	516	257	298	342	397	517	468	192	410	473	3870
July	351	339	350	302	292	482	412	313	497	188	3526
Aug.	485	145	835	502	425	385	582	338	398	870	4965
Sep.	223	527	553	146	607	293	152	199	163	572	3435
Oct.	333	644	616	570	170	427	330	425	325	293	4133
Nov.	432	555	127	479	235	525	192	579	522	709	4355
Dec.	400	57	439	269	423	456	37	299	548	132	3051
Sum	4365	4267	3821	4428	3326	5066	3716	3414	3781	5043	41227

	1689	90	91	92	93	Sum
Jan.	333	707	197	54	218	1509
Feb.	393	171	112	168	78	922
March	875	145	476	347	298	2136
April	468	78	386	498	539	1969
May	182	244	300	330	93	1149
June	302	179	412	416	181	1490
July	120	218	285	448	112	1183
Aug.	222	402	193	198	668	1683
Sep.	442	403	215	605	641	2306
Oct.	740	765	165	273	514	2457
Nov.	415	717	230	148	627	2137
Dec.	368	262	169	892	261	1952
Sum	4860	4291	3140	4372	4230	20893

All we can learn from these observations, is, that here we have almost just twice the quantity of rain that falls at *Paris*; but as *Lan-*

Lancaſhire and particularly about *Townley* where theſe obſervations were made, is generally eſteemed to have much more rain than other parts, it would be unjuſt without farther obſervations of the like nature in other places, that all *England* ſhould be eſtimated to abound as much in rain as theſe parts do: The pounds and parts doubled give both the quantity of half pounds, and the height in inches; with this difference, that for the half pounds, only the laſt figure is a decimal fraction, and the others the number of the half pounds; and that for the height, the two laſt figures denote the decimal fraction of an inch, and the remainder the height in inches, ſo near the truth, that they only fall ſhort of it 1 inch in 200, which defect is eaſily ſupplied; to this needs only be added, that the numbers, on the right hand are the ſums of all thoſe in the ſame line, that is, in the firſt part of ſeveral numbers for ten years; ſo that the laſt of them ſhews the ſum both of the half pounds that have fallen during that ſpace of time, and the height the water would have been raiſed in that ſame time; for example, the ſum of all the rain in the ten firſt years is 41227, and therefore according to what hath been ſaid, 412,27 is the number of half pounds that fell in the compaſs of the tunnel during thoſe ten years; and 412,27 the height it would have raiſed the water during that time; but if you deſire greater accurancy, add 206, its two hundredth part, and you will have 414,33, for the true height, and 41,433 for the mean height, by theſe 10 years obſervations, and 412,27 for the mean quantity of half pounds; by the ſame method you will have the means for the other five; *viz*, of height 41, 78, and 417, 8 for the mean number of half pounds, which means do ſurpriſingly agree, and both conſidered, do give for the mean in all the 15 years 41,516 inches in height, which is about $\frac{1}{2}$ of an inch more than double that at *Paris*, which is ſtated at 19 $\frac{1}{2}$ *French* inches, which make 21 *Engliſh:* Mr. *Townley*'s method of gauging by weight is grounded on this, that 22,7368 cubical inches of rain-water, are equal in weight to 1 pound, or 12 ounces *Troy*; ſo that dividing any ſuperfices in inches of a veſſel, for receiving the rain-water, by the abovementioned number, it will give the pounds and parts that will raiſe the water on that ſurface, with upright ſides, juſt an inch; and this he found that 4,974 pounds would fill a cylinder equal at the bottom to Mr. *Townley*'s tunnel, and an inch high, which is nearly 5 pounds, and which will only raiſe the cylinder higher by $\frac{1}{250}$ part.

The

G. Smith del. Hulett Sculp.

The Cuntur *of* Peru, *and the* Coffee-ſhrub; *by Dr.* Sloane. Phil. Tranſ. N° 208. p. 61.

THE magnitude aſcribed to the *Cuntur* or *Condor* of *Peru*, as well as its great force and ſtrength, have been the cauſe, that many have doubted of its reality: Cap. *J. Strong*, commander of a ſhip, which went into the *South Seas* thro' the *Streights* of *Magellan* gives this account of it; *viz.* that on the coaſt of *Chili*, they had met with this bird in about 33° S. Lat. not far from *Mocha*, an iſland in the *South Seas*, that his men were much amazed at its bigneſs, and that after they had killed it, it meaſured 16 foot from one wing to the other, that they were told by the *Spaniards* that it was the *Cuntur*, and that they were afraid of this bird, leaſt it ſhould prey upon, or injure their children; one of its feathers was two foot four inches long, the quill-part 5 ¾ inches, and 1 ½ inch about in the longeſt part; it weighed three dram 17 ½ grains, and was of a dark brown colour, very hollow or concave on one ſide, and convex on the other: The ſeamen ſhot it as it ſat on a cliff by the ſea-ſide, and eat it, taking it for a ſort of turkey.

Mr. *Edw. Clyve*, the firſt who brought a dried branch of the coffee ſhrub A A Fig. 1. Plate V. from *Mecca* in *Arabia Felix*, gives this account thereof; this branch was taken off a tree 7 or 8 foot high, was about 5 foot long, and covered with a grey ſmooth bark; the wood was white, and the pith not very large; the twigs were covered with a dark-coloured ſmooth bark and roſe oppoſite to each other in pairs, coming out of oppoſite ſides of the branch, and cutting each other at right angles; in the ſame manner the leaves ſtood on the twigs, as the twigs did on the branches, at the diſtance of an inch and ſometimes two inches from each other; the leaves had ¼ inch foot-ſtalks, being about 4 inches long, and two broad in the middle where broadeſt, whence they decreaſed to both extremities, ending in a point; they were ſmooth, entire, and without any inciſures on their edges, ſomewhat like the leaves on a bay; the fruit comes *ex alis foliorum*, hanging to the twig by ½ inch long ſtrings or footſtalks; with one, two or more in the ſame place: Theſe ſhrubs are planted in great numbers in *Arabia Felix*, called *Jaman*, in a rich mould, and are watred in times of drought, by artificial canals cut on purpoſe from rivers; and after 3, 4, or more years bearing, they are forced to plant new ſhrubs, becauſe the old ones are not ſo fruitful after that time; they dry them in the ſun, and afterwards take off the outer huſk of the berries by means of hand-

hand-mills; and the *Arabs* in ſummer heats uſe theſe huſks, roaſted after the manner of coffee-berries, eſteeming the drink more cooling, as being ſouriſh to the taſte: A A repreſents the ſhrub, wherein is obſervable the manner of its branching and of the growing of the leaves and fruit; *aaaa* the fruit growing two, three, or more at a place on the twigs; B one of the leaves, of its natural bigneſs; C the fruit, of the true ſize and figure; *c* the fruit, with the huſk on; *e* the fruit, with the outer huſk taken off; *i i* the berry, with both huſks taken off.

An Earthquake *in* Jamaica. Phil. Tranſ. N° 209. p. 89.

THE year 1692 began in *Jamaica* with very dry and hot weather, which continued till *May*, when it became very windy and rainy, till the end of the month; from which time, till the earthquake happened, it was exceſſive hot, calm, and dry; and on *Tueſday* the 7th of *June*, about 40 minutes paſt 11 o'clock in the forenoon, it being then a very hot, clear, ſun-ſhiny day, ſcarcely a cloud to be ſeen in the ſky, or a breath of air to be felt, that great ſhock, ſo fatal to this iſland, happened; it began with a ſmall trembling, which was ſucceeded by a ſtronger ſhake, together with a hollow rumbling noiſe, almoſt like that of thunder; immediately upon this, there enſued a third violent ſhock, which in leſs than a minute's time ſhook the very foundations of *Port-royal*, that three parts in four of the houſes, and the ground whereon they ſtood, and moſt of thoſe who inhabited them, ſunk at once quite under water, and the houſes, on the ground that was left, were ſhattered in a violent manner, ſcarcely one houſe in ten was left ſtanding, and thoſe ſo ſhattered, that few of them were fit to live in; all the ſtreets next the water towards the harbour ſide, lay in 6 or 8 fathom water, where formerly were excellent wharfs, cloſe to which ſhips of 700 tun might lie and unload, and where ſtood the beſt ſtore-houſes and conveniencies for merchants, and the moſt ſtately buildings: The ſhock was ſo violent that it threw people down on their knees, and ſometimes on their faces, as they ran about the ſtreets to provide for their ſafety, and it was a very difficult matter to keep on one's legs, the ground heaving and ſwelling like a rolling ſea, by which means ſeveral houſes, that continued to ſtand, were ſhuffled and moved ſome yards from their places; in many places the ground would crack, open and ſuddenly ſhut again, in which openings ſeverals were ſwallowed up; ſome were caught by the middle and ſqueezed to death; the heads of others only appeared above ground; ſome were ſwallowed quite down, and caſt up

again

again with great quantities of water; others went down without being ever after ſeen; larger openings ſwallowed up great houſes, and out of ſome gapings whole rivers of water would iſſue forth, ſpouted up to a great height into the air, which ſeemed to threaten a deluge, and were accompanied with offenſive ſmells; and by theſe openings, and the vapours emitted from the earth into the air, the ſky, which before was clear and blue, was in a moment's time become dull and reddiſh, like a red hot oven; all thoſe dreadful circumſtances occurring at once, and accompanied all the time with prodigious loud noiſes from the mountains, cauſed by their falling, *&c.* and alſo with a hollow noiſe under ground, and people running from one place to another with ghaſtly looks and more reſembling the dead than the living, made it a very melancholy ſcene: Tho' *Port Royal* ſuffered much by the earthquake, yet it left more houſes ſtanding there than in all the iſland beſides; it was ſo violent in other places, that people could not keep on their legs, but were forcibly thrown down on the ground; it ſcarcely left a planter's houſe or ſugar-work ſtanding all over the iſland; in ſeveral places in the country the earth gaped prodigiouſly, and houſes, people and trees were ſwallowed up, and the place was afterwards become a great pool or lake of water; and in ſome places theſe gapings or openings ſpouted up with prodigious force great quantities of water into the air; but the mountains ſuffered the greateſt ſhocks, emitting at the ſame time loud noiſes and echoings; not far from *Yellows*, part of a mountain, after it made ſeveral leaps or removes, overwhelmed a whole family, and a great part of a plantation, lying a mile off; and a large high mountain near *Port Morant*, about a day's journey over, was quite ſwallowed up, and in the place where it ſtood, there ſucceeded a great lake of 4 or 5 leagues over. The tops of great mountains in their fall ſweeped down with them trees and other things in their way; and theſe vaſt pieces of mountains with all the trees thereon, falling together in a huddled and confuſed manner, ſtopped up moſt of the rivers for about 24 hours, which afterwards having found out new channels, brought down into the ſea ſeveral hundred thouſand tons of timber, floating therein in ſuch prodigious quantities that they ſeemed like moving iſlands: Some were of opinion that the mountains were ſunk a little, and others thought that the whole iſland ſubſided a little, and *Port Royal* was ſaid to be ſunk a foot, and in many places in *Liguania*, their wells did not require ſo long ropes to draw water out of them, as before the earthquake, by two or three foot: In the harbour of *Port Royal* at the time of the great ſhock, tho' the

seas were very calm, there was suddenly raised such a strange emotion in the water, that immediately it swelled as in a storm; great large waves appearing on a sudden, rolling with such force, that they drove most ships in the harbour from their anchors, breaking their cables in an instant; in *Liguania* the sea retired from the land in such a manner that for two or three hundred yards the bottom of the sea appeared dry, and the fish were left behind, and in a minute or two's time the sea returned again and overflowed a great part of the shore; at *Yallhouse* the sea retired above a mile; 2000 persons were supposed to have perished in this earthquake: It is observed, that in windy weather there never happens a shock, but in very calm weather it is always expected; that after rain, the shocks are generally smarter than at other times, which may be caused by the shutting up of the pores of the earth, whereby the force is more pent in, and hath not so free a passage as to perspire and spend itself, *&c.* that since the earthquake, the land-breezes often fail, and instead thereof the sea-breezees blow all night; a thing rarely known before, but since common; in *Port Royal*, and in many places all over the island, much sulphureous combustible matter hath been found, which upon the least touch of fire would flame and burn like a candle: St. *Christophers*, one of the *Caribbee Islands* was formerly much infested with earthquakes, but upon the eruption of a great mountain of combustible matter, which still continues, they wholly ceased, and have never since been felt there; which gave some hopes that some such eruption in some of the mountains of *Jamaica* would free that island from earthquakes.

The Distance of the Fix'd Stars; *by Mr.* Francis Roberts. Phil. Trans. N° 209. p. 101.

SINCE the *Pythagorean* system of the world has been revived by *Copernicus*, and now adopted by all mathematicians for the true one, there seemed ground to imagine, that the diameter of the earth's annual orbit, which, according to our best astronomers, is at least 40000 times bigger than the semidiameter of the earth, might give a sensible parallax to the fixed stars, thereby to determine their distance; but there are some considerations, which make us suspect that even this basis is not large enough for that purpose: M. *Huygens*, who is very exact in his astronomical observations, tells us, he could never discover any visible magnitude in the fixed stars, tho' he used glasses which magnified the apparent diameter above 100 times; now since in all likelihood the fixt stars are suns, perhaps of different magnitudes, we may,

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as a reaſonable medium, preſume that they are generally about the magnitude of our ſun; let us then, for inſtance, ſuppoſe the dog-ſtar to be ſo; the diſtance from us to the ſun being about 100 times the ſun's diameter, it is evident, that the angle under which the dog-ſtar is ſeen in M. *Huygen*'s teleſcope muſt be nearly the ſame with the angle of its parallax to the ſun's diſtance, or ſemidiameter of the earth's annual orbit; ſo that the parallax to the whole diameter can be but double ſuch a quantity, as even to M. *Huygens*'s nice obſervation is altogether inſenſible; the diſtance therefore of the fixt ſtars ſeems hardly within the reach of any of our methods to determine; but from what has been laid down, we may draw ſome concluſions, that will much illuſtrate the prodigious vaſtneſs thereof. 1. That the diameter of the earth's annual orbit, which contains at leaſt 160 millions of miles, is but a point in compariſon of this diſtance, at leaſt it muſt be above 6000 times the diſtance of the ſun; for if a ſtar ſhould appear thro' the aforeſaid teleſcope half a minute broad, which is a pretty ſenſible magnitude, the true apparent diameter would not exceed 18‴, which is leſs than the 6000th part of the apparent diameter of the ſun; and conſequently, the ſun's diſtance is not the 6000th part of the diſtance of the ſtar. 2. That could we advance towards the ſtars 99 parts of the whole diſtance, and have only the 100th part remaining, the ſtars would appear little bigger to us than they do here; for they would ſhew no otherwiſe than they do thro' a teleſcope, which magnifies an hundred-fold. 3. That at leaſt 9 parts in 10 of the ſpace between us and the fixt ſtars can receive no greater light from the ſun, or any of the ſtars, than what we have from the ſtars in a clear night. 4. That light takes up more time in paſſing from the ſtars to us, than we in making a *Weſt India* voyage, which is ordinarily performed in ſix weeks; that ſound would not reach us at that diſtance in 50000 years; nor a cannon-bullet in a much longer time; this is eaſily computed, by allowing, according to Mr. *Newton*, 10 minutes for the paſſage of light from the ſun hither, and that ſound moves above 1300 feet in a ſecond of time.

Obſervations on epidemical Diſtempers; *by Dr.* Tho. Molyneux. Phil. Tranſ. N° 209. p. 105.

ABOUT the beginning of *November* 1693, after a conſtant courſe of moderately warm weather for the ſeaſon, upon the fall of ſome ſnow, of a ſudden it grew extremely cold, and ſoon after there ſucceeded ſome few days of a very hard froſt; upon which rheums of all kinds, ſuch as violent coughs, that

chiefly affected the patients in the night-time, great defluxions of thin rheum at the nose and eyes, immoderate discharges of the *Saliva* by spitting, hoarseness of voice, sore throats, with some pain in swallowing, wheezings, obstructions, and soreness in the breast, a dull heaviness and stoppage in the head, with such like disorders, the usual effects of cold, affected great numbers of all sorts of people in *Dublin*: Some were more violently affected, so as to be confined for some time to their beds; and they complained of feverish symptoms, as shiverings and chilness, which often returned; of pains in several parts of their bodies; severe head-aches, chiefly about the forehead, so that the least noise affected them; great weakness in their eyes, that the least light was offensive; a perfect decay of all appetite; foul turbid urine, with a brick-coloured sediment at the bottom; great uneasiness and tossings in their beds all night; yet these disorders would usually, without any remedies, abate of themselves, and terminate in universal sweats, that constantly relieved; this more violent degree of the cold, was apter to affect such as were given to excess either in eating or drinking, or such as were inclinable to a scrophulous dispositon of body, than on those that were more temperate, and less subject to obstructions: When the cold was but moderate, it was usually over in eight or ten days; but with those, in whom it arrived to a greater height, it continued a fortnight, three weeks, and sometimes above a month; some way or other, it universally affected every body; those in the country, as well as those in the town; those that were much abroad in the open air, and those that staid much within doors; the robust and hardy, as well as the weakly and tender; and if it was favourable to any, they were the aged, many of whom escaped it: As it first appeared towards the beginning of *November*, so it seemed to arrive to its greatest degree of violence, and spread most universally about the middle of it, and by the beginning of the ensuing month it very sensibly abated, so that very few did then complain of their colds; and in the space of four or five weeks it had its rise, growth, and decay; and tho' this cold was so universal, none died thereof, except such whose strength was before spent by some tedious fit of sickness, or laboured under some heavier disease complicated therewith: This cold was as universal in *England*, and with the same symptoms as it affected those in *Dublin*, but with this difference, that it appeared three or four weeks sooner in *London* than in *Dublin*; it also reached the continent, and infested the northern parts of *France*; also *Flanders*, *Holland*, and the rest of the *United Provinces*, with more

more violence, and no leſs frequency, than it did theſe countries; ſo that hardly was ever any epidemic diſtemper obſerved to extend ſo far: No inſtance of any epidemic diſtemper ſeems in all reſpects to come nearer to this general cold, than the tranſient fever in 1688; this fever was firſt obſerved in *Dublin*, about the beginning of *July*; and it ſo univerſally ſeized all degrees of men whatever, that not above one in fifteen eſcaped; it begun as generally fevers do, with a chilneſs and ſhivering all over, like that of an ague, but not ſo violent, which ſoon broke out into a dry burning heat, with great uneaſineſs, which commonly confined the patients to their beds, where they paſſed the enſuing night in a very reſtleſs manner; they complained likewiſe of giddineſs, and a dull pain in the head, chiefly about the eyes, with wandering pains in the limbs, and about the ſmall of the back, with aches all over the body, a loſs of appetite, a *Nauſea*, and an unuſual ill taſte in the mouth, yet little or no thirſt; and tho' theſe ſymptoms were very violent for a time, yet they did not continue long; for about the ſecond day of the diſtemper, the patient uſually of himſelf fell into a ſweat, unleſs it was prevented by letting blood, which, however beneficial in other fevers, manifeſtly retarded the progreſs of this; and if the ſweat was encouraged for five or ſix hours, by laying on more cloaths, or taking ſome ſudorific, moſt of the diſorders above-mentioned would entirely vaniſh, or at leaſt very much abate; giddineſs and want of appetite would often continue ſome days after, but by uſing the freſh air, they would infallibly in four or five days at fartheſt recover, and be perfectly well; this tranſient diſeaſe was ſo favourable, that not one in a thouſand died of it, and by the middle of *Auguſt* it wholly diſappeared, ſo that its whole period was ſeven weeks; it alſo ſpread itſelf all over *England*, and raged as generally in *London* as in *Dublin*, and with the ſame ſymptoms; but it began to be obſerved at *London* about the middle of *May*, and continued there till the latter end of *June*, ſo that it did not ſhew itſelf at *Dublin* till it had wholly diſappeared there; and it was very remarkable, that in *England*, as well as at *Dublin*, a little time before this general fever, a ſlight diſeaſe, but very univerſal, affected horſes too, and ſhewed itſelf by a great defluxion of rheum from their noſes; which proves the cauſe of ſpreading diſtempers to be ſo powerful, as to affect not only the finer and more delicate compoſition of human bodies, but even the ſtronger and groſſer frame of the moſt robuſt animals in nature: From theſe hiſtories one may probable infer, that ſpreading epidemic diſtempers take their progreſs from eaſt to weſt;

weſt; but this ſhould be farther confirmed by more frequent obſervations, before one can ſafely determine any thing on this head; however, it is certain, that the plague and peſtilential fevers rage more frequently in the eaſt, towards *Conſtantinople* and the *Levant*, than in theſe more weſtern parts of *Europe*.

Phyſiognomy; *by Dr.* Gwither. Phil. Tranſ. N° 210. p. 118.

SOFT wax is not more capable of receiving more numerous and various impreſſions, than are imprinted on man's face by objects that move his affections; and not only the objects themſelves have this power, but alſo the very images, or ideas, themſelves; that is, any thing that puts the animal ſpirits into the ſame motion that the object, when preſent did, will have the ſame effect with the object itſelf: To prove the firſt, let one obſerve a man's face, that looks on a pitiful object, then a ridiculous, and then on a frightful or dangerous object, *&c.* For the ſecond, that ideas have the ſame effect with the object, dreams confirm this oftentimes.

The manner Dr. *Gwither* conceives to be thus; the animal ſpirits, moved in the ſenſory by an object, continue their motion to the brain, whence it is propagated to this or that particular part of the body, as is moſt ſuitable to the deſign of its creation, having firſt made an alteration in the face by its nerves, eſpecially the pathetic and *Oculorum motorii*, actuating its ſeveral muſcles; not that he thinks, the motion of the ſpirits in the ſenſorium to be continued by the impreſſion of the object all the way, as from the finger to the foot; but he conceives it done in the *Medulla* of the brain, where is the common ſtock of ſpirits; as in an organ, whoſe pipes being uncovered, the air ruſhes into them, but upon letting go the keys, they are ſtopped again; now, if by repeated acts, or by frequently entertaining the ideas of a favourite paſſion, or vice, which natural temperament, or cuſtom, have hurried one into, the face is ſo often put into that poſture, which accompanies ſuch acts, that the animal ſpirits find ſuch paſſages into its nerves, that it is ſometimes unalterably ſet (as the *Indian* Religious are by long continuing in ſtrange poſtures in their pagods) but moſt commonly ſuch a habit is contracted, that the face falls inſenſibly into that poſture, when ſome preſent object does not obliterate that more natural impreſſion by a new one, or diſſimulation hide it: Hence it is, that we ſee great drinkers with eyes generally ſet towards the noſe, the adducent muſcles being often employed to let them ſee their beloved liquor in the glaſs in the time of drinking, which were therefore called *Bibitory*; laſcivious

vious persons are remarkable for the *Oculorum mobils petulantia*, as *Petronius* calls it; from this also we may solve the *Quakers* expecting face, waiting the pretended spirit, and the melancholy face of sectaries; the studious face of men of great application of mind; and the revengeful face of bloody men, like executioners in the act; and tho' silence in a sort may a while pass for wisdom, yet sooner or later, Sir *Martin* peeps thro' the disguise, and marrs all; a changeable face is observed to indicate a changeable mind: But the doctor would by no means have what has been said to be understood, as without exception; for he doubts not but sometimes there are found men with great and virtuous souls under very unpromising outsides.

A Continuation of the Account of Virginia, *by Mr.* Clayton. Phil. Trans. N° 210. p. 121.

THERE were neither horses, bulls, cows, sheep, or swine in all the country, before the coming of the *English*; they never shoe or stable their horses, yet they ride pretty sharply; a planter's pace is a proverb, which is a good hand-gallop: In the uninhabited parts there are wild bulls and cows, and they are hard to be shot, having a great acuteness of smelling; their sheep are of a middling size, tolerably fine fleeced in general, and most persons of estate keep flocks of them; the country abounds in good red deer; the *Indians* are said to make artificial heads of boughs of trees, which they consecrate to their gods, and these they put on to deceive the deer, and mimicking their feeding, they by degrees get within shot of them; swine they have now in abundance; shoats or porkrels are their general food, and it is as good as any *Westphalia*, at least far exceeding our *English*: Rackoon is a species of a monkey, something less than a fox, grey-haired, its feet formed like a hand, and the face too has the resemblance of a monkey's; besides, being kept tame, they are very apish; they prove very prejudicial to their poultry: An opossum is as large, and something shaped like our badgers, but of a lighter dun colour, with a long tail somewhat like a rat, but as thick as a man's thumb; the skin of its belly is very large and folded, so as to meet like a purse, wherein they secure their young whilst little and tender, and into which these latter run as naturally, as chickens to a hen; in these false bellies, they carry their young; they feed on, and devour corn: Many will have their hares to be hedge-rabbets, but Mr. *Clayton* takes them to be a perfect species of hares, because he had seen leverets there, with the white spots in the head, which the old ones have not; and the down is per-

perfectly of the colour of our *Engliſh* hares; they ſit as our hares do, and make neither holes nor burrows in the earth; it is true they are about as large as an *Engliſh* rabbet, and they run no faſter; they generally betake themſelves into ſome hollow tree, and they are taken by gathering the withered leaves, and ſetting them on fire within the hollow of the tree; ſometimes they take long briars, and twiſt them in the down and ſkin, and ſo pull them out: They have three ſorts of ſquirrels; the firſt is the great fox-ſquirrel, much larger than the *Engliſh*, and almoſt as grey as a common rabbet; theſe are very numerous, and they eat as well as a rabbet; the ſecond is the flying-ſquirrel, of a lighter dun colour, and much leſs than the *Engliſh* ſquirrel; the ſkin, on either ſide the belly, is very large between the fore and hinder legs, which aſſiſts them very much in their ſkipping from one bough to another, that they will leap farther than the fox-ſquirrel, tho' ſmaller; the third is the ground-ſquirrel, they are ſaid to be a little larger than a mouſe, and finely ſpotted like a young fawn; they are a ſort of dormouſe, only different in colour: Muſk-rats are exactly ſhaped like our water-rats, only ſomething larger; they build houſes, as beavers do, in marſhes by the water-ſide, with two or three ways to them, and they are finely plaiſter'd within; they conſiſt of three ſtories, and they retire from one into the other, as the water riſes: There are two ſorts of bats; one of which is large with long ears and particularly long ſtraggling hairs, the other is much like the *Engliſh*, but ſomething larger: Beavers build their houſes in like manner as the muſk-rats do, only they are larger; with pieces of timber they make dams over rivers; either to preſerve their furs dry in their paſſage over them, or to catch fiſh; they are very ſubtle creatures: They have ſeveral ſorts of frogs; one of a prodigious largeneſs, eight or ten times as big as any in *England*, and it makes a noiſe like the lowing of a bull, or the hollowing ſounding noiſe of a bittern; there is another ſmall ſort of frog, which makes a noiſe like pack-horſe bells during all the ſpring; a third ſort, which is alſo green, will leap prodigiouſly, and on that account is called the flying-frog: There are in *Virginia* about 7 ſorts of ſnakes; as the rattle-ſnake, which is ſo called from certain rattles at the end of the tail; theſe rattles appear like ſo many withered joints with a dry huſk over them; and the common opinion is, that there are as many rattles or joints as the ſnake is years old; the young ones of a year or two have no rattles, yet they are eaſily known, being checquered with black and grey on the back; the old ſnakes ſhake and quiver theſe rattles with ſurpri-

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ſing agility, when they are any way diſordered; their bite is very noxious, but not always of the ſame efficacy, but more or leſs mortal, as the ſnake is in force and vigour; and therefore in *June* or *July*, the bite is much worſe, and more fatal than in *March* and *April*; this ſnake is a majeſtic ſort of creature, and will ſcarcely meddle with any thing, unleſs provoked; but if any thing offend it, it makes directly to it: An *Indian*, being bit by one of theſe ſnakes between the fingers, bound his arm as hard as poſſible with a ſtring, and clapped a hot burning coal on the place, and ſeared it, whereby he was cured, but he looked pale for ſome time after; and this Mr. *Clayton* thinks one of the beſt methods for curing the bite either of a viper or mad dog; and he ſuppoſes the efficacy of their poiſon to conſiſt in thickening the blood; vipers, and all the viperous kind, as rattle-ſnakes, *&c.* that are noxious, have their teeth fiſtulous; and therefore they kill ſo very ſuddenly, by injecting the poiſon thro' thoſe fiſtulous teeth into the maſs of blood; now as the effect of this poiſon is to coagulate the blood, as ſeveral malignant fevers alſo do, in all ſuch caſes volatile ſalts ſeem to be the propereſt phyſick, as they keep the blood fluid; and bleeding ſeems to be very prejudicial, as it diminiſhes the ſpirits, and congeals the blood the ſooner; and by this method, Mr. *Clayton* had cured ſeveral patients: The blowing-ſnake is an abſolute ſpecies of a viper, but larger than any to be ſeen in *Europe*; it is ſo called, becauſe it ſeems to blow and diſtend its head, and ſwell very much before it bites, which is very mortal; it is very remarkable, that none of theſe ſnakes make that hiſſing noiſe, as thoſe in *England* do, but only ſhoot out their tongues and ſhake and quiver them: There is another ſort of deadly ſnake, called the *Red-ſnake*; they are of an ugly dark-brown colour, inclining to red; their bellies are of a more duſky white, with a large ſtreak of vermillion-red on either ſide; this too is of the viper kind: The horn-ſnake is another ſpecies of deadly ſnake, ſo called from the horn it has in its front, wherewith it ſtrikes, and its wound is as mortal as the bite of the rattle-ſnake; this ſpecies may properly be referred to the dart-ſnake: The black-ſnake is the largeſt, its bite is not deemed mortal, but the wound ſwells and turns to a running ſore; they feed on lizards, mice, rats, frogs, and toads: The corn-ſnake is of all others moſt like the rattle-ſnake in colour, but the checquers are not ſo regular, neither has it any rattles; they are moſt frequent in corn fields, and hence probably the name; their bite is not venemous: The water-ſnake is a ſmall ſnake, they are of an

ugly dark blackish colour, and they are reckoned the least venemous of any.

The Dissection of a Paroquet; *by Mr.* Rich. Waller. Phil. Trans. N° 211. p. 153.

THERE is a great variety of species in the parrot-kind, whether we consider the country, size or colour; *Johnson* says, the curious have observed above an hundred sorts of them: The sixth species, by *Margravius*, comes very near our subject; its size is between a sparrow and a black-bird, with a short neck, black eyes, a crooked scarlet bill, greyish legs and feet, with toes, two before and two behind, like the parrot; yet he never stands on one foot to eat with the other, as parrots do; when he stands still on the perch, his breast and belly shew of a curious light green, his back, and the feathers of his wings, are somewhat darker; on his pinions are some short blue feathers, as also several on his rump; his bill is encompassed up to the eyes with a broad beautiful scarlet circle, reaching also down to his throat; this part in the hen is of a paler orange-colour, and this is the only observable difference; the feathers of the tail, which in all small paroquets is no longer than the wings, are not to be seen but when he flutters or spreads it; they are about two inches long near the quill, of a lemon colour, inclining to a green, next a scarlet for a pretty space, then a narrow streak of green on some of them, after that a black, and last of all ending in a light green: Having opened the *Thorax* and *Abdomen*, by blowing into the *Aspera Arteria*, a large cavity or bladder was raised up all along the *Abdomen* to the edges of the *Os Ischion*, and fastened to the gizzard, containing in it all the guts and gizzard, but excluding the heart and liver; a conformation like this, is observed in all birds, and peculiar to them: The *Aspera Arteria* differs from that of most other animals, having not only a *Larynx* at the top thereof, as is usual, but another also at its entrance into the breast, where it is divided, and branches itself into two; from this structure, which is said to be common to all parrots, it may possibly be, that they can so readily imitate human voices; but this animal never attempts an imitation of words, making only a shrill chirping noise, doubling the tone, or making it eight notes lower, as a stopped organ-pipe is an eighth to the same open; this lower *Larynx* may assist the weak fabric of so small a creature as a parrot, to counterfeit so bass a voice as a man's; it being observed by some ingenious persons, that parrots

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are *Ventriloqui*, and that it may be queried, whether all ventriloquous cheats may not by nature be framed for such an imposture: The heart, in proportion to the animal, was large, and the liver small: The tongue was broad and thick, at the extremity somewhat like a man's, whence a parrot hath its name ἀνθρωπογλωττος; its extremity was armed with a horny cover: It has, besides the gizzard, two craws, the uppermost being only a receptacle, or sack for the food, which is canary-seed, to be again returned to the mouth, where it is re-chewed, having before been only husked, this animal ruminating as some quadrupeds do; and Mr. *Waller* observed this bird, when upon the perch, not only bring up its food again into its mouth, and there chew it, but when the cock and hen sit together on the perch, he would put the food out of his own mouth into the hen's; their manner of chewing is thus, the under bill, being much shorter, shuts within the upper, or against the roof of the mouth, which is fitted with several rows of very small cross-bars, as the mouths of horses, dogs, and some other animals are; these bars are not soft, but horny, as being part of the upper bill; so that the bird, by carrying the edge of the under bill and end of the tongue, against the ridges in the upper, breaks and reduces to a pap the seeds that have been first moistened in the craw, to expedite which action, the upper bill is joined just below the eyes; the food, being thus macerated, is by the *Gula* again committed to the second craw, but before its entrance into it, it passes by a number of small glands, placed in that part of the *Gula*; that the food may squeeze out of them in its passage, a juice, of what necessity in digestion may be enquired; from hence the food passes into the gizzard, or proper ventricle, small in comparison of the *Ingluvies*, or crop; where, by several stones picked out of the sand given it, and by the motion of the gizzard, it is comminuted, and thence transmitted to the intestines, on the sides of which, within a small distance, is placed the *Pancreas*.

The explication of the figures; *a*, Fig. 2. Plate V. the *Aspera Arteria*; *b* that part which forms, as it were, another *Larynx*; *c* part of the *Gula*; *d* the upper craw; *e* the heart; *ff* the *Venæ axillares*; *gg* the jugulars; *h* a small gland on one of them; *ii* the two auricles of the heart; *kk* the liver; *l* the gizzard.

a, Fig. 3. the *Trachea*; *bb* the *Larynx*, by which parrots are rendred ventriloquous; *cc* the two branches of the *Trachea*.

a a, Fig. 4. the *Cornua* of the *Os Hyoides*; *b b* two muſcles of the *Larynx*; *c* the fiſſure or *Glottis*; *d* the *Trachea*; *e* the tongue; *f* the horny end thereof.

a a Fig. 5. the *Teſtes*; *b b* the *Deferentia*; *c c* the kidneys; *d d* the *Ureters*.

a Fig. 6. the upper part of the *Gula*; *b* the firſt or upper craw; *c* that part of the *Gula*, whoſe inſide is glandulous; *d* the lower craw; *e* the gizzard or the ventricle; *f* the firſt inteſtine; *g g* the *Pancreas*.

a Fig. 7. the upper bill; *b* the inſide of it; *d d* the upper jaw; *c* the place where the upper bill is moveable; *e* a paſſage to the noſtrils; *f* the lower bill; *g* the upper bill in another poſition, to ſhew the ſmall ridges therein.

An obſtinate Jaundice, *accompanied with an odd Caſe in* Viſion; *by Mr.* Sam. Dale. Phil. Tranſ. N° 211. p. 158.

GRACE *Dennys* of *Braxted Magna* in the county of *Eſſex*, about *Chriſtmaſs* 1689, after great grief and trouble of mind the preceeding autumn, began to be affected with the jaundice; for which, after having about 9 months uſed many medicines, which were told her by her friends and acquaintance, but without ſucceſs; ſhe in *September* 1690 applied herſelf to Mr. *Dale*, who preſcribed ſeveral medicines, famous in the moſt celebrated authors for the cure of the jaundice, yet they were of no benefit to her; after which ſhe had the advice of ſeveral learned phyſicians both in the country and at *London*, but without any effect; and her body which uſed to be plump and fleſhy was become lean and emaciated, almoſt like a ſkeleton, and her appetite was little and depraved: In *May* 1691, after an extraordinary menſtrual flux for about three months, ſhe began, as ſoon as the ſun was down, to be deprived of her ſight by degrees till it was quite dark, when, tho' there was never ſo big a fire, or never ſo many candles in the room, yet ſhe could not diſcern any object, except a ſmall glimmering of light, and thus ſhe continued till morning, as one ſtone blind, when by little and little, as the light encreaſed, her ſight returned, till the ſun roſe, and then ſhe recovered her perfect ſight: In this caſe ſhe continued till *Auguſt* 1692, when returning from *Epſom*, where ſhe had been drinking the waters for about a month, her ſight returned to her again, ſo that ſhe could ſee perfectly in the night; thus ſhe continued till *January* following, when an extraordinary menſtrual flux ſeizing her again, ſhe alſo loſt her nocturnal ſight, and became

came blind again as formerly: In *July* 1693, ſhe was ſeized with a fever, when her ſight again returned, and continued for about a month, and then left her as formerly; ſo that now in *October* 1693 ſhe hath her nocturnal blindneſs, and the jaundice likewiſe continues.

Obſervations on ſeveral Poiſons; *by Sir* Theodore Mayerne. Phil. Tranſ. N° 211. p. 162.

THE venom of a viper in itſelf is not mortal to a robuſt and ſound body, and tho' very unhappy and miſchievous accidents attend it, as a great tumour, tenſion, and weight of the part, humidity and variety of colour, phrenſies, convulſions and vomitings, yet in 8 or 10 days at moſt theſe ſymptoms are over; and altho' the patient may be very ill, yet he recovers again; whilſt the poiſon having run thro' divers parts of the body, at laſt throws itſelf into the *Scrotum*, cauſes a great heat and quantity of urine, very hot and ſharp, by which the poiſon is diſcharged; this evacuation being the ordinary and moſt certain criſis of the diſeaſe: It is obſervable, that perſpiration being obſtructed by the poiſon, a man bit by a viper, and ſwelled up, in three or four days will weigh almoſt as much more than he did before; a ſickly perſon, under an ill habit of body, or fearful, infallibly dies by this venom, and that in a ſhort time, if not ſpeedily relieved; in the extreme nervous parts near the pulſe and tongue, the bite is dangerous, and the ſymptoms very painful; freſh vipers, that have not bit, but have the bladders of the gums full of poiſon, are the moſt miſchievous; wherefore mountebanks, to impoſe on the people, either make their vipers bite before they bring them out, or, with a needle ſcratch the gums, and ſqueeze out the poiſon. The remedy for theſe great and painful ſwellings is, to drink the decoction of *Marrubium*, or the powder taken internally, and to make a fomentation with the decoction; applying a cataplaſm, made with *Marrubium*, *tapſus barbatus* and *Agrimony*, on the place; *Ariſtolochia* is alſo a ſtrong and powerful antidote againſt the viper; ſo that if one be bit on the tongue, he need only take a ſlice of this root, heat it, and apply it, and it makes a cure. *Pontæus*, a chemical mountebank, from whom Sir *Theodore* had the abovementioned obſervations, had compoſed his antidote, of extract of juniper-berries drawn with a decoction of roots of round *Ariſtolochia*, of *Succiſa*, *Marrubium album*, flowers of brimſtone and of white vitriol; for poiſons not corroſive, ſuch as thoſe of animals and vegetables, and even for

for the plague itſelf, which he imagined he could cure by the ſame remedy, he made uſe of no vitriol; but if the poiſon was ſublimate, which of itſelf excites vomiting, he added vitriol; not in a proportion to vomit, as a drachm, but only a ſcruple, or half a drachm, the vomiting being aſſiſted by the corroſive poiſon itſelf: To encreaſe the value of this antidote with the people, when the experiment was made on dogs, *Pontæus* gave that dog which was to die of the bite of the viper together with the antidote a quarter of a *Nux vomica*, not powdered but only cut in bits, and the next day the dog would die; if it were powdered the dog would die in half an hour; and he ſaid, *Nux vomica* never vomits but ſhuts up the ſtomach, and contracts the nerves by its poiſon; to preſerve the dogs alive, you muſt give them with the antidote or any thing elſe, three or four grains of ſublimate, which immediately ſets them a vomiting, and ſo ſaves them alive; he much eſteemed *Morſus Diaboli*, *Succiſa*, or devil's bit, againſt all ſorts of poiſons, eſpecially the plague; a toad, he ſaid, had no poiſon, any more than a frog.

The manner of the action of the viper's poiſon is thus; in about $\frac{3}{4}$ of an hour, a ſyncope or ſwooning ſeizes the patient with trembling, and convulſions, tingling of the ears, and frequently deafneſs for a moment; next, as it were, a whitiſh miſt appears before his eyes, which ſoon vaniſhes; the part, that is bit, ſwells, at firſt as big as a pea, after that it grows as big as a bean or a nut, and encreaſing, it ſpreads over the neighbouring parts to a very conſiderable tumour and tenſion of the fleſh, which grows oedematous, and by little and little falls into the *Scrotum*, and leaves the part black, blue and yellow; it makes as it were bags in the ſkin, which feel heavy when you walk, as if ſtuffed with quick-ſilver; uſe what means you will, the poiſon will have its courſe, and it is uſually three days before it comes to its height, and it is as long abating; *Pontæus* affirms, that the gall of the viper is not poiſonous, and that all the poiſon is in the liquor in the gums, which is yellow like oil; the viper is the moſt venomous of ſerpents, the aſp is but a ſpecies of the viper; *Napellus* is a very dangerous poiſon, acting by its acrimony, but you muſt take a great quantity of it, it burns the throat like alum; opium is the moſt miſchievous of all poiſons.

The

The Giant's Cauſway; *by Dr.* Sam. Foley. Phil. Tranſ. N° 212. p. 170.

THE *Giant's Cauſway* is above 8 *Engliſh* miles north-eaſt from the town of *Colrain*, and about three from the *Buſh-mills*, almoſt directly north; it runs from the bottom of an high hill into the ſea, how far is not known, but at low water its length is about 600 foot, and its breadth, in the broadeſt place, 240 foot, in the narroweſt part 120; it is alſo very unequal in height, being in ſome places 36 foot above the level of the ſtrand, and in other places about 15 foot; it conſiſts of many thouſand pillars, moſt of which ſtand perpendicular to the plane of the horizon, and cloſe to each other; but Dr. *Foley* could not diſcern whether they run down under ground like a quarry or not; ſome of the pillars are very long and taller than the reſt, others ſhort and broken; ſome again for a great way are of an equal height, ſo that their tops form a level plain ſurface; many of them are imperfect, crack'd and irregular; others entire, uniform and handſome, and theſe of different ſhapes and ſizes; they are almoſt all pentagonal or hexagonal, only a few have ſeven ſides, and the pentagons are more numerous than the hexagons, but they are all irregular; ſome of the pillars are 15, ſome 18 inches, ſome again two foot in diameter; none of them is one entire ſtone, but every pillar conſiſts of ſeveral joints or pieces, of which ſome are 6, ſome 12, ſome 18 inches, ſome 2 foot deep; theſe pieces lie as cloſe as it is poſſible for one ſtone to lie upon another, not jointing with flat ſurfaces, but one of them is always concave in the middle, the other convex; theſe joints are not always placed alike; for in ſome pillars the convexity is always upwards, and in others it ſtands always downwards; when you force them aſunder, both the concave and convex ſurfaces are very ſmooth, as are alſo the ſides of the pillars, which touch each other, being of a whitiſh free-ſtone colour, but of a finer and cloſer grit; whereas upon breaking ſome pieces off them, the inſide appears like dark marble. The pillars ſtand cloſe to each other, and tho' ſome have five ſides, and others of them ſix, yet their contexture is ſo adapted, that there is no vacuity between them, the inequality of the numbers of the ſides of the pillars, being often in a very ſurpriſing and wonderful manner, throughout the whole cauſway, compenſated by the inequality of the breadths and angles of thoſe ſides; ſo that the whole at a little diſtance looks very regular, and every ſingle pillar retains its own thickneſs, its angles and ſides from top to bottom. Thoſe pillars, which

ſeem

ſeem to be entire as they were originally, are at the top flat and rough, without any ſtriated lines; thoſe that lie low to the ſea are waſhed ſmooth; and others, that ſeem to have their natural tops blown or waſhed off, are ſome concave, and others convex. The high bank hanging over the cauſway on that ſide which lies next it, and towards the ſea, ſeems to be for the moſt part compoſed of the common ſort of craggy rock, only there are a few irregular pillars on the eaſt-ſide, and ſome farther on the north, called the *Looms*, or *Organs*, ſtanding on the ſide of a hill, the pillars in the middle being the longeſt, and thoſe on each ſide of them becoming ſhorter and ſhorter; but juſt over the cauſway, the tops of ſome pillars appear out of the ſides of the hill, neither ſtanding or lying flat, but ſloping. The ſeveral ſides of one and the ſame pillar are, as in the planes of cryſtals, of very unequal breadths; and in ſuch as are hexagonal, a broader ſide always ſubtends, or is oppoſite to, a narrower; which ſort of geometry, nature alſo obſerves in the formation of cryſtals.

The Evaporation of Water *in a cloſe Room*; *by Mr.* Edm. Halley. Phil. Tranſ. N° 212. p. 183.

IN order to explain the circulation of vapours experimentally, Mr. *Halley* cauſed an experiment of the quantity of vapours riſing ſimply from the warmth of the water, without being expoſed either to ſun or wind, to be made in *Greſham* college; and adding up into one ſum the evaporations of the whole year, he found, that from a ſurface, as near as could be meaſured, of eight ſquare inches, there did evaporate 16292 grains of water, which is 64 cubic inches of water, and that divided by eight inches, the area of the ſurface of the water, ſhews that the depth of water evaporated in one year, amounts to eight inches. But this is by much too little to anſwer the experiments of the *French*, who found that it rained 19 inches of water in a year at *Paris*; or thoſe of Mr. *Townley*, who, by a long continued ſeries of obſervations, hath ſufficiently proved, that in *Lancaſhire*, at the foot of the hills, there falls above 40 inches of water in a whole year; whence it is very obvious, that the ſun and wind are much more the cauſes of evaporation than any internal heat or agitation of the water. The ſame obſervations do alſo ſhew an odd quality in the vapours of water, which is that of adhering to the ſurface whence they exhaled, which they cloath, as it were, with a fleece of vaporous air, which once inveſting it, the vapours riſe afterwards in much leſs quantity; which appeared by the ſmall quantity

quantity of water that was loſt in the ſpace of 24 hours, when the air was very calm, in proportion to what evaporated when there blew a ſtrong gale, tho' the experiment was made in a place as cloſe from wind as could be well contrived; for which reaſon, Mr. *Halley* does not at all doubt, that had the experiment been made, where the wind had come freely, it would have carried away at leaſt three times as much, without the aſſiſtance of the ſun, which might perhaps have doubled it. By the ſame experiment it likewiſe appears, that the evaporations in *May*, *June*, *July*, and *Auguſt*, which are nearly equal, are about three times as much as what evaporates in the four months of *November*, *December*, *January*, and *February*, which are likewiſe nearly equal; *March* and *April* anſwering almoſt to *September* and *October*. This fleece of vapours in calm weather, hanging on the ſurface of the water, is the occaſion of very ſtrange appearances, by whoſe refraction, differing from that of the common air, every thing appears raiſed, as houſes like ſteeples, ſhips as if on land above the water, and the land elevated, and, as it were, lifted from the ſea, and often ſeeming to overhang. And this may give a tolerable account of ſeeing the cattle at high-water in the *Iſle of Dogs* from *Greenwich*, where none are to be ſeen at low-water; which ſome have endeavoured to explain, by ſuppoſing the *Iſle of Dogs* to be raiſed by the tide running under it; but the vaporous effluvia of water, having a greater degree of refraction than the common air, may ſuffice to bring thoſe rays down to the eye, which, when the water is retired, and the vapours ſubſide therewith, paſs above; and conſequently objects ſeen at one time, may be conceived to diſappear at another time.

A Stove *for preſerving Plants*; *by Sir* Dudley Cullum. Phil. Tranſ. N° 212. p. 191.

SIR *Dudley* made a ſtove in his green-houſe, according to Mr. *Evelyn*'s invention, publiſhed in the *Calendarium Hortenſe*; he laid his pipes of crucible earth, not too near the fire-grate, which was about 16 inches; he made a trench the whole length of his houſe under the paving, about 18 inches in breadth, and as many in depth, covered with an arch of bricks; at the other end of the trench, having an iron plate about 18 inches ſquare, to take off and put on, with a round hole at each corner, of about three inches diameter, with a lid to ſlide open and ſhut; ſo that by opening any of theſe holes, or all of them more or leſs, or taking off the whole plate, a certain quantity of air might be admitted to blow the fire more or leſs; and for the more equal diſtributing the air at its admiſſion thro' the houſe, he inſerted his pipes into a channel all along the wall, at the end of

the houſe, with thoſe ſeveral overtures mentioned by Mr. *Evelyn*, all which ſucceeded admirably well.

A Catalogue *of thoſe* Oils *that will take Fire with a great Noiſe and Exploſion, when the Compound ſpirit of Nitre is poured upon any of them; and of thoſe* Oils *that only make a great Noiſe with Exploſion, but will not take Fire; and alſo of thoſe, that neither cauſe an Effervescence or Exploſion. The firſt is marked with two Stars **. The ſecond with one *. The laſt has no mark at all; by Dr.* Slare. Phil. Tranſ. N° 213. p. 200.

OILS

Eſſential — *Vegetable*

Perfect *Stillations* made by the *Analyſis* of the *chymical Fires*, where the *oleaginous* Particles are truly ſeparated from all other, — *Seeds.*

- *Carvi* **
- *Cummin* *
- *Fennel* *
- *Dill* *

Berries.

- *Juniper* *
- *Bay* *
- *Thyme* *

Tops of *Plants.*

Light, or *Æthereal*, which are *ſpecifically* lighter than *Water* and *Brandy*, and ſome than *Spirit* of *Wine*, and are uſually drawn from the *Seeds* of *Vegetables*: Such as from

- *Wormwood* *
- *Angelica* *
- *Hyſop* *
- *Lavender* *
- *Roſemary* *
- *Penny royal* *
- *Rue* *
- *Sage* *
- *Savin* *

Fruits.

- *Lemons* *
- *Oranges* *
- *Nutmegs* *
- *Cloves* **

Wood.

Ponderous or heavy, which do commonly ſink in *Water*, being diſtilled from the heavy Parts either of the *Wood* or *Cortex* of *Trees*. Such as from

- *Saſſafras* **
- *Guajacum* **
- *Box* **
- *Campbire* **

Cortex.

- *Jamaica Pepper* **
- *Cinamon* **

Not Eſſential

Fruits.

Imperfect, made by *Expreſſion*, which are decompounded of ſeveral Parts of the *Plants*; as of

- *Almonds*
- *Olives*
- *Walnuts*

Seeds.

- *Line*
- *Rape*

Animal of *ſolid* Parts — —

- *Hartſhorn* **
- *Man's Skull* **
- *Hoofs* **

Fluid — — — —

- *Humane Blood* **

Mineral of — — — —

- *Amber* or *Succinum.*
- *Petroleum.*
- *Barbado's Tar.*
- *Bee's Wax.*

Take

Take of any of the eſſential oils, ſet down in the catalogue, one part, of the compound ſpirit of nitre two parts, (and theſe may be drachms) and they will, with great celerity and noiſe, produce a flame, which laſts a very little while, but leaves an inſipid *Caput Mortuum*, as light and taſtleſs as a cobweb.

Note, 1. This experiment ſhould be made under a chimney, or any convenient draught, that ſo the offenſive ſteams may evaporate. 2. A gally-pot, capacious enough to hold 4 or 5 ounces of water, may be a convenient veſſel for this experiment, if you only uſe the abovementioned proportion; but if you uſe larger quantities, then you muſt enlarge the veſſel. 3. You muſt put the oil into the galley-pot firſt, becauſe the ſpirit, being heavier, does the better paſs thro' the oil, and make a more expeditious mixture, and it muſt not be dropped in gradually, but all at once. 4. Take care not to hold your head too near the galley-pot, leaſt the ſudden exploſion of the matter ſhould throw up ſome of it into your face. 5. The compound ſpirit will loſe much of its virtue, if kept too long.

To prepare the compound ſpirit of nitre, take of ſaltpetre and oil of vitriol equal parts, and diſtill theſe out of a retort in a good ſand-furnace, ſo that the ſand continue red-hot for ſome hours, for the fire cannot be too great; the fumes will ariſe of a very deep red colour, and will ſettle in the receiver in the form of a liquor, which muſt be carefully preſerved from the air, this being the ſpirit with which all the experiments were made, which are referred to in the catalogue. To make the common ſpirit of nitre, you need only mix 5 or 6 times as much clay as you take of nitre, and diſtil them in a retort, and you may obtain a ſtrong ſpirit of nitre this way, eſpecially if you dephlegmate and rectify it to the beſt advantage; with this Dr. *Slare* made an experiment of accenſion, that ſucceeded ſometimes, but with great uncertainty, the firſt, which is called the compound ſpirit of nitre, being only to be relied on; this compound ſpirit ſeems to be the active principle that ſtirs up the oily, or more paſſive particles to take fire; which will more eaſily be allowed, if we conſider that the compound ſpirit of nitre does not only conſiſt of all thoſe igneous particles to be found in common ſpirit of nitre, but that it has alſo thoſe fiery particles, which oil of vitriol contains, crouded into the ſpirit of nitre. For farther illuſtration let us conſider, that oil of vitriol is a creature of the fire, that the ſulphur, which is plentiful in vitriol, or copperas, is accended, and afterwards diſtilled over in the form of a liquor, which is a liquid ſort of fire, as having many properties thereof; if you put it to

water, it will make it boiling hot; it burns not only linnen and woollen, but alſo wood to a coal, and ſcarcely ſpares any thing. Nitre, the other ingredient of this ſpirit, is very ſuſceptible of flame, which does alſo incorporate many igneous and corroſive particles, after it has ſo many hours lain ignited in the fire, and comes over, by diſtillation, very highly impregnated with the ſame fiery particles, as is obvious to any one that hath uſed to make experiments therewith; for nitre itſelf has no diſſolving or heating quality, but is a great cooler and can hardly be reckoned amongſt acids; but after it comes out of the fire, in the form of a ſpirit, it tears to pieces almoſt all metals, and brings them to a ſort of fuſion, as actual fire does; it diſſolves animals, vegetables, and minerals, and produces many of the effects of fire; therefore from an union of theſe very fiery ſpirits there reſults a much greater quantity of igneous matter. That fire is very apt to incorporate with fluids, and even ſuch as have had but a ſmall communication therewith, appears probable from an experiment exhibited before the Royal Society; there was taken of ſpirit of wine highly rectified, a wine glaſs half full, and a tender thermometer was placed in the glaſs, and then a ſpoonful of water was put to it, this immediately warmed the liquor, and made the weather-glaſs aſcend two inches; the liquor in the weather-glaſs ſubſided as the other mixture grew cold. The ſame thing was made ſenſible to the touch, by filling the palm of the hand with ſpirit of wine, and putting a ſmall quantity of cold water into the ſame hand, and it ſenſibly warmed the hand. Dr. *Slare* is of opinion that there is ſcarcely any thing, which lies long in the fire, but is apt to retain ſome igneous particles; which appears to be the caſe in all fixt ſalts, in quicklime, and more particularly in iron; if you take a bar of iron, tho' a hundred years old, and file off about a pound of it, and then mix and ſoak theſe filings in a due proportion of water, enough to make the whole juſt moiſt; the fire, which all this while lay concealed in the iron, being more diſpoſed to enter into the fluid, does, by theſe means, warm the whole maſs. The iron gained this heating quality by fuſion in thoſe fierce fires, which firſt ſeparated the metal from the ore; for that it is not in the nature of the ore before fuſion to emit any heat, has been found by mixing water therewith. There are a great many other inſtances, which make it very plain, that fire will add both to the bulk and weight of bodies.

Oils may be diſtinguiſhed into vegetable, animal, and mineral; vegetable oils are again ſubdivided into thoſe made by expreſſion, and thoſe by diſtillation; and of thoſe made by diſtillation, ſuch

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as are made out of the ſeeds are diſtinguiſhed from thoſe made out of the trunks, bark, roots, or any other part of the vegetable; there is farther a difference obſerved between thoſe ſeeds, that have only a fragrant ſmell, and a pungent taſte only, and thoſe that have both odorous effluvia and a briſk taſte, and alſo thoſe that are inſipid, and have no ſmart taſte. In the firſt place we muſt ſet aſide thoſe oils made by expreſſion; for having tried oil of linſeed, of nuts, of olives, of almonds, &c. they would neither make an exploſion or ebullition, or ſo much as any fermentation with the compound ſpirit of nitre; nor could they be brought to incorporate without much ſtirring; and when they did unite, the heat was but juſt ſenſible. To examine briefly the mineral oils, there are ſome, as oil of vitriol, oil of ſulphur *per Campanam*, that have not any property of oils, but are rather acids and corroding menſtruums: there are others which have the true property of eſſential oils, as *oleum Petreoli*, and *Barbados* tar highly rectified, which do not produce any remarkable heat, much leſs an ebullition or exploſion, nor does that active oil of amber do any thing more; the ſtillatitious oil of bees-wax had much the ſame effect, when incorporated with the compound fiery ſpirit; and this makes it probable that wax itſelf may be a compound rather of a mineral than vegetable nature. Now of thoſe eſſential oils, which produce a great ebullition, exploſion, and flame with the compound ſpirit there are two ſorts, vegetable and animal; the true vegetable eſſential oils do all of them make a violent ebullition and exploſion, and ſeveral of them actually take fire and flame, as the catalogue of experiment ſpecifies. If it be inquired into, what ſhare the oil has in producing this fire, whether it be only a *pabulum* or fuel, for the ſpirit to actuate, and ſo be merely paſſive? Or whether it contributes any particles that help to excite this flame? In order to the reſolving this doubt, we are to conſider, that theſe eſſential oils are produced from ſeeds, that have very active or warm parts or ſpirits, ſuch as will eaſily ferment and heat; and beſides the potential heat of the vegetable, eſſential oils contain a volatile ſalt, which gives much of that pungency to the taſte; therefore theſe oils are not a bare *pabulum ignis*, or an unactive principle, but do on a double account, as well on the ſcore of the incaleſcent oil as of the inherent ſalts, conſpire with the compound ſpirit to make this great heat, exploſion and accenſion. In the catalogue of experiments, we may farther obſerve, that of the light eſſential oils drawn from ſeeds of vegetables, all of them do make a great ebullition with an exploſion but that few of them do actually take fire; and that all thoſe,

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extracted from trunks, or other parts of vegetables, do certainly take fire, and flame; wherefore obſerving, that thoſe that do not take fire or flame, do yet make as great an exploſion and ebullition, and probably as great a heat, as thoſe that did, one might be apt to impute this to the lightneſs and too great ſubtility and volatility of thoſe eſſential oils, whoſe very active particles too ſoon exhale, or fly away; and this conjecture ſeems to be juſtified by the addition of a more ramous body, as balſam of ſulphur made with oil of turpentine, to the moſt volatile and ſubtile oils, which then produce a flame, whoſe particles being groſſer, or more ramous, will detain the more volatile oil from too ſudden an exploſion, and give more time to the fiery ſpirit to penetrate, and mix itſelf with thoſe combuſtible materials; and this may be one reaſon, why the ponderous oils diſtilled from the roots or ligneous parts of a plant do all take fire; *viz.* becauſe the parts of this ſort of oil, lying cloſer together, do not ſo ſoon diſſipate after the ſpirit is thrown upon it; and then, as to the ſpecific gravity, the difference is alſo very conſiderable, which any one may find by this familiar way; if you fill a glaſs with one ounce of the eſſential oil of the ſeeds, you will require nine drachms of the ponderous oil of the vegetable to fill up the ſame ſpace; this is alſo obvious to any ſpectator, that moſt of theſe oils, thus diſtilled, are more ponderous than common water, by their ſinking to the bottom; whereas all eſſential oils, extracted from the ſeedy parts, do ſwim on water, and ſome are lighter than the beſt rectified ſpirit of wine, but moſt of them are lighter than brandy, which has made the Chemiſts call them etherial oils. In the catalogue of experiments, you may find which are the ponderous oils that do conſtantly take fire: Moreover, the ponderous oils have yet one advantage over the lighter volatile oils; for being expoſed to a longer and greater degree of fire than the others, they unite more igneous particles, which being put into motion, may contribute ſomething to cauſe this accenſion.

The oils diſtilled from animal bodies do all of them take fire and flame, but with this difference, that they do not produce ſo great an exploſion as the vegetable do, but do more certainly take fire, and continue their flame longer, but not ſo fierce as the other. If we rightly examine the conſtitution or texture of this oil, we have ſeveral properties adapted to the production of this effect; there is a much greater degree of fire required in the diſtillation of this oil than is neceſſary for that of the vegetable; a greater quantity alſo of volatile ſalts do paſs over with the oil; and

and the oil is ponderous, and ſinks in water; all which circumſtances will contribute to a more conſtant accenſion.

Oleum Succini is juſtly put in the catalogue of minerals, and is produced by a ſtrong degree of fire, yet it cauſes no motion, and ſcarcely any incaleſcence, notwithſtanding it abounds in volatile ſalts; the reaſon is, becauſe theſe ſalts are not properly volatile, as alcali's are, but do belong to the family of acids, and ſo can make no fermentation with this compound ſpirit, which is itſelf highly acid.

One ſurpriſing effect of this fiery mixture was as follows; half a drachm of the oil of carvi-ſeed was poured into a ſmall gally-pot, which was placed under a glaſs that held three pints upon M. *Papin*'s exhauſting engine, and having cleared it of air, the phial was turned up, in order to ſee what effect would enſue in this ſort of *Vacuum* upon this mixture; but in a moment the receiver was blown up, and the mixture in a flame; which was the more ſurpriſing, as the honourable Mr. *Boyle* found that in all his experiments the removal of the air did almoſt always extinguiſh both light, fire, and flame. The blowing up of the glaſs does alſo make the experiment the more extraordinary, and puzzles one how to account for ſo great a quantity of air, as was produced from theſe liquors, which amounted only to a drachm and a half; for here was required not only air ſufficient to fill up the capacity of the veſſel, but likewiſe ſo great a preſſure within, as exceeded that great incumbent weight of air that preſſed on this capacious glaſs without, whoſe diameter was ſix inches, and depth above eight, for otherwiſe it would not have thrown it up into the air.

This fiery mixture and gun-powder agree, in that both do heat, burn, and flame, and alſo do conſiderably reſiſt and raiſe up bodies that oppoſe them; in both, the air is much agitated and expanded; but they differ, in that gun-powder will not be made to take fire, or make any exploſion *in Vacuo*; that gun-powder is a compoſition of the drieſt and moſt combuſtible materials; whereas one of the two fluids is not eaſily made to burn by itſelf, and the other will extinguiſh common fire; that gun-powder requires actual fire to bring it to an accenſion; whereas in this you have only two liquors, both cold to the touch, that produce fire and flame by the bare joining and mixing them together.

The Difference of Timber *in different Countries, and felled at different Seaſons; by M.* Leewenhoeck. Phil. Tranſ. N° 213. p. 224.

IT is the common opinion, that timber, which is felled in winter, is ſtronger and more laſting, as being cloſer and firmer than that which is felled in ſummer; but M. *Leewenhoeck* is of opinion, that there is no difference, except in the bark, and outmoſt ring of the wood, which in the ſummer is ſofter, and ſo more eaſily pierced by the worm; wood conſiſting of hollow pipes, which, both in ſummer and winter being full of moiſture, do not ſhrink in winter, and therefore the wood cannot be cloſer at one time than another, for otherwiſe it would be full of cracks and clefts. The ſudden and unexpected rotting of ſome timber, he conceives to proceed from ſome inward decay in the tree, before it was felled; having obſerved all trees to begin to decay at firſt in the middle, or heart of the tree, tho' poſſibly the tree may ſtand and grow for near a hundred years afterwards, and increaſe in bigneſs all along. He ſays, he was once of opinion, that trees, growing in good ground, but increaſing ſlowly, were the beſt and ſtrongeſt timber; and that thoſe trees, which in few years grew large, were the ſofteſt and britleeſt; the contrary to which, upon inquiry of experienced workmen, he found to be true, and he inſtances in an elm of 80 years growth, which was 11 foot in circumference, and proved excellent tough timber. The age of trees is to be known by the number of rings to be ſeen, when the tree is cut a-thwart, in each of which rings is one circle of large open pipes; now the fewer there are of theſe large pipes, the ſtronger the timber is; wherefore, by conſequence, theſe trees that make the largeſt growth in a year, muſt be the cloſeſt and ſtrongeſt, and therefore thoſe trees, that grow in warm countries, grow faſteſt, and are the beſt and toughest timber; which he confirms by *Riga* and *Dantzic* oak, which is of a ſlow growth, and proves ſpongy and brittle timber; whereas the contrary is obſervable in *Engliſh* and *French* oak, which grows faſter, and is excellent timber.

The Polarity of Iron. Phil. Tranſ. N° 214. p. 257.

IT is known, that a rod of iron held perpendicular to the horizon, or inclining, the lower end is its north pole, or attracts the ſouth end of a magnetic needle; and that the ſame end held upwards, becomes a ſouth pole, or attracts the north end of the needle,

needle, and repels the ſouth end. That is a mutuble pole, which may be north or ſouth, as you hold it; and a fixed pole, that which does not change, however you hold it. The ſpecies of the pole, whether north or ſouth, may be found by paſſing the iron rod thro' cork or wood, and then leaving it to ſwim on water, it will turn to its proper pole; but this way is ſlow, and not accurate; a better way to try, for inſtance, a north pole, is to hold the iron perpendicular to the horizon, and to try, whether being held under the north end of the needle, it attracts it; but a yet better way is to try whether the upper end of the rod attract the ſouth end needle; for attraction is more ſenſible than repulſion. A fixed north pole may be made after all the ways, and with all the rods that you can make a fixed ſouth pole, but not on the contrary; for there are many caſes, wherein you can make a fixed north pole, but not a fixed ſouth pole; and whatever way you obtain a fixed ſouth pole, it is weaker than a fixed north pole made the ſame way; applying a needle to an erect bar, beginning at the top, and ſo down, the needle turns not at the middle, but nearer; of ſome rods you cannot make a fixed ſouth pole primarily, yet you may conſequentially; ſo you may make one end a fixed north pole, and then the other end of thoſe rods may, without more a-do, become a fixed north pole; but this doth not always hold, for the one may be a fixed north pole, and the other may be a mutable pole. Fire deſtroys all fixed poles, whether made by the magnet, or otherwiſe; but it increaſes, or rather leſs impedes that magnetiſm, which proceeds from the earth; a wire or rod of iron heated at one end, that end becomes a mutable pole, but more vigorous whilſt hot than cold; the vigour of mutable poles is more in great than ſmall rods; but it is otherwiſe in fixed poles. Heat the end of a rod of iron red hot, or heat all the rod, and cool that ignited end northwards, it will be a fixed north pole; if cooled ſouth, it becomes a fixed ſouth pole; this *Gilbert* and others aſſert from experience, but this holds only in ſome caſes; *viz.* if the rod is ſhort, you cannot make a fixed pole that way. Take a round wire, whoſe diameter is $\frac{1}{5}$ inch, and length 10 inches, you cannot produce a fixed pole by ignition; but if this wire was longer, as ſuppoſe 30 inches, or never ſo much longer, it is capable of a fixed pole by ignition. Again, take a round rod 30 inches long, and 1 inch in diameter, this rod is not capable of a fixed pole at that length, tho' the leſſer was capable thereof at the ſame length; and experiments give reaſon to think, that there is not any rod or bar of iron ever ſo thick, but which, if it had ſufficient length, would be capable of a fixed pole by

bare ignition; and there is no rod, ever so short, but which, if you make it sufficiently thin, is capable of a fixed pole; the necessary length, for every thickness, increases more than one would think. Heat a rod, or its end, red hot, and thoroughly cool this end downwards, or towards the *Nadir*, it will have something more of magnetism than if cooled horizontally towards the north, but the better way is to cool it, a little inclining towards the north; repeated ignitions do not produce more magnetism than one good ignition, but it must be thoroughly heated; nor does quenching in water contribute to the producing or hindering magnetism; but many ignitions may accidentally promote it, by purifying the iron. Dr. *Power* says, that if a rod is held northwards, and the north end is hammered in that position, it will become a north pole, *i. e.* a fixed north pole; contrarily, if you hammer the south end; but this is true, as we said before of ignitions, only in rods of a certain length and thickness. What is said of hammering is to be understood of filing, grinding, drilling, sawing, even a soft rubbing, providing it be done for some time, will produce fixed poles; the heavier the blows are, *cæteris paribus*, the magnetism is the greater; I say, *cæteris paribus*, as when the blows are not so heavy in either case as to flat the iron; for flatting it produces more magnetism, tho' other things do not vary; a few hard blows will produce as much magnetism as many, yet a soft blow may cause but little magnetism; the utmost magnetism produced this way, did not exceed what an ordinary magnet would have communicated. Striking many rods of proper lengths northwards, a fixed north pole never failed to be produced; but hammering the same, or like rods, southwards, no fixed south pole could be produced, only a mutable pole; nay, hammering one full south, the author produced a fixed north pole, which he thought might be owing to this, that the hammered south end on the anvil was a little lower than the end he held in his hand; then he held the end higher, and so hammering it southwards, he never failed producing fixed south poles in proper rods. Old drills and punches are fixed north poles, because almost constantly used downwards. The stronger the polarity is, the longer it will last; a weak fixed pole may degenerate into a mutable pole in a day's time; on the contrary, needles, touched with good loadstones, hold that virtue a great while, if kept from air, and in a meridian site. The loadstone itself will not make a fixed pole of any iron; it must have a proper length if it is thick; or if it is short, it must have a sufficient thinness; so ordinary or weak loadstones

ſtones cannot fix a pole in a thick ſhort key, which yet they will do in a ſmall key; ſo in a ſhort thick iron, tapering, a loadſtone may fix a pole in the ſmall end, when it cannot in the great end. When ignition, hammering, or a loadſtone cannot make fixed poles, it muſt not be thought that it can do abſolutely nothing on ſuch rods; for even then it may be found, that there is an effect of maguetiſm in them diſcerniable enough otherwiſe, tho' not ſufficient to make fixed poles. When you have the due length for making of a fixed pole, you will find that the making one a fixed north, will conſequently render the other a fixed ſouth pole; but if keeping the ſame diameter of this rod, you encreaſe its length ſufficiently the making one end a fixed north pole will not neceſſarily make the other a fixed ſouth pole, but leave it a mutable pole; ſo if you by a like primary operation make the ſecond end a fixed pole, the firſt will looſe it's fixedneſs and become mutable; I ſay, there is a certain length ſuited to every thickneſs of iron, to leave one end mutable, whilſt the other is fixed, and the thicker the iron is, the greater is the length; if you farther encreaſe the length of the ſame rod, you will attain ſuch a length, that when you have fixed a pole on one end, then go to fix the other end, the fixity of the firſt will not be deſtroyed, and that end become mutable as before, but the fixity of the firſt end will remain; and ſo you may make both ends two fixed north poles, or two fixed ſouth poles; I ſay the ſhorteſt length (there are no limits of the greateſt length) for this is more in thick, than in thin iron. The aforeſaid lengths are leſs, according to the ſtrength of magnetiſm; *viz.* ignition requires a greater length than when a rod is actuated by a loadſtone, and a rod touched with a ſtrong load ſtone requires leſs length than one touched with a weak one.

To find the Sun's Ingreſs *into the Tropical* Signs; *by Mr.* Edm. Halley. Phil. Tranſ. N° 215. p. 12.

MR. *Halley* does here give a method of finding the moments of the ſolſtices, capable of all the exactneſs the moſt accurate can deſire, and that without any conſideration of the parallax of the ſun, of the refractions of the air, of the greateſt obliquity of the ecliptic, or latitude of the place; all which are required to aſcertain the times of the equinox from obſervations, and which, being faultily aſſumed, have occaſioned an error nearly of three hours in the times of the equinoxes, deduced from the tables of the noble *Tycho Brahe* and *Kepler*; the vernal being ſo much later, and the autumnal ſo much earlier than by the cal-

culus of these famous authors; so that it is an easier matter to be assured of the moments of the solstices or of the times of the sun's entrance into *Cancer* and *Capricorn*, than it is to observe the true times of the equinoxes, or his ingress into *Aries* and *Libra*.

Mr. *Halley*, before he proceeds, thinks it necessary to premise the following *Lemmata*, which serve to demonstrate this method, *viz.* 1. That the motion of the sun in the ecliptic, about the time of the solstices, is so nearly equable, that the difference from equality is not sensible, from 5 days before the solstice to 5 days after it, by reason of the nearness of the apogæon of the sun to the *Tropic* of *Cancer*. 2. That for five degrees before and after the solstices, the differences, whereby the sun falls short of the *Tropics*, are as the versed sines of the sun's distance in longitude from the *Tropics*; which versed sines in arches under 5 degrees, are beyond the utmost nicety of sense, as the squares of those arches; from these two there follows a third. 3. That for 5 days before and after the solstices, the declination of the sun falls short of the utmost tropical declination, by spaces which are as the squares of the times, the sun is short of, or past, the solsticial moment. Hence it is evident, that if the shadows of the sun, either in the meridian or any other azimuth, be carefully observed about the time of the solstices, the spaces, whereby the tropical shadow falls short of, or exceeds, those at other times, are always proportional to the squares of the intervals of time between those observations, and the true time of the solstice; and consequently, if the line, on which the limits of the shadow are taken, be made the axis, and the correspondent times from the solstice, expounded by lines, be erected on their respective points in the axis as ordinates, the extremities of those lines will touch the curve of a parabola: Thus, *a*, *b*, *c*, Fig. 8. Plate V. being supposed to be the points observed, the lines *a* B, *b* C, *c* A, *e* F, are respectively proportional to the times of each observation before or after the solstitial moment in *Cancer*.

This being premised, we shall be able to bring the problem of finding the true time of the solstice by 3 observations to this geometrical one; having 3 points in a parabola, A, B, C, or A, F, C, given, together with the direction of the axis, to find the distance of those points from the axis. Of this there are two cases, the one, when the time of the second observation B is precisely in the middle between A and C; in this case, putting t for the whole time between A and C, we shall have A c, the interval of the remotest observation A, from the *Tropic*, by the following analogy: As $2ac - bc$ is to $2ac - \frac{1}{2}bc$, so is $\frac{1}{2}t$ or A E to

A c

A c the time of the remoteſt obſervation A from the *Tropic*. But the other caſe, when the middle obſervation is not exactly in the middle between the other two times, as at F, is ſomething more operoſe, and the whole time from A to C, being put $= t$, and from A to F $=$ S, ce, $= c$, and $bc = b$; the theorem will ſtand thus $\frac{ttc - bfs}{2tc - 2bs} =$ A c, the time ſought.

To illuſtrate this method of calculation, it may perhaps be requiſite to give an example or two for the ſake of thoſe aſtronomers, that are leſs inſtructed in the geometrical part of their art.

Anno 1500 *Bernard Walther*, in the month of *June*, at *Nuremberg*, obſerved the chord of the diſtance of the ſun from the zenith, by a large parallactic inſtrument of *Ptolemy*, as follows;

June 2, 45467		*June* 8, 44975
June 9, 44934	and	*June* 12, 44883
June 16, 44990		*June* 15, 44990

In both theſe caſes, the middle term is exactly in the middle between the extremes, and therefore in the former three, $ac = 533$, $bc = 477$, and t, the time between being 14 days, by the firſt rule, the time of the ſolſtice will be found by this proportion; as 589 to 827 $\frac{1}{2}$; ſo is $\frac{1}{2}$ t or 7 days, to 9 days, 20 h. 2′; whence the ſolſtice *An.* 1500 is concluded to have fallen *June* 11, 20 h. 2′. In the latter three, ac is equal to 107, and $bc = 15$, and the whole interval of time is 8 days $= t$; whence as 199 is to 206 $\frac{1}{2}$; ſo is 4 d. to 4 d. 3 h. 37′, which, taken from the 16th day at noon, leaves 11 d. 20 h. 23′ for the time of the ſolſtice, agreeing with the former to the third part of an hour.

Again, *An.* 1636, *Gaſſendus* obſerved at *Marſeilles* the ſummer ſolſtice by a gnomon of 55 foot high, in order to determine the proportion of the gnomon to the ſolſtitial ſhadow, and he hath left us the following obſervations, which may ſerve as an example for the ſecond rule.

June 19 N. S.		31766	
June 20	ſhadow	31753	parts, whereof the
June 21		31751	gnomon was 89428
June 22		31759	

Theſe being divided into two ſets of 3 obſervations each; *viz.* the 19th, 20th and 22d; and the 19th, 21ſt and 22d; we ſhall have

have in the first three, $c = 13$ and $b = 7$, $t = 3$ days $1 = f$; and in the second, $c = 15$, $b = 7$, $t = 3$, and $f = 2$; whence, according to the rule, the 19th day at noon the sun was short of the *Tropic* a time proportional to one day, as $ttc = ssb$ to $2tc - 2bs$; that is, as 100 to 64 in the first set, or 105 to 62 in the second set; that is, 1 d. 17 h. 15′ in the first, or 1 d. 17 h. 25′ in the second set; that is, 1 d. 17 h. 15′ in the first, or 1 d. 17 h. 25′ in the second set; so that we may conclude the solstitial moment to have been *June* 10 d. 17 h. 20′ in the meridian of *Marseilles*. Now that these two solstitial times thus obtained, will be found to confirm each others exactness from their near agreement, appears by the interval of time between them, *viz.* 1 d. 2 h. 30′ less than 136 *Julian* years, whereof 1 d. 1 h. 8′ arises from the defect of the length of the tropical year from the *Julian*, and the rest from the progression of the sun's apogæon in that time; so that no two observations made by the same observer in the same place can better answer to each other, and that without any the least artifice or force in the management of them.

What were the methods of the ancients to conclude the moment of the solstice, *Ptolemy* has no where mentioned; but it were to be wished, that they had been aware of this, that so we might have been more certain of the moments of the solstices we have received from them; which would have been of singular use to determine the question, whether the sun's apogæon be fixed, or, if it move, what its true motion is. It is certain that if we take the account of *Ptolemy*, the solstice said to be observed by *Euctemon* and *Meton*, *June* 27th in the morning, *An.* 432 before Christ, can no ways be reconciled, without supposing the observation made the ensuing day, or *June* 28th in the morning; and the solstice observed by *Ptolemy* himself, in the third year of *Antoninus An. Christi* 140, was certainly on the 23d, and not on the 24th of *June*; as will appear to those that will duly consider and compare them with the length of the year deduced from the diligent and concordant observations of those two great astronomical genii, *Hipparchus* and *Albatani*, established and confirmed by the concurrence of all the modern accuracy; for the observations give the length of the tropical year, such as to anticipate the *Julian* account only one day in 300 years; but we are now certain, that the said period of the sun's revolution does anticipate very nearly 3 days in 400 years; so that the tables of *Ptolemy*, founded on that supposition, do err about a whole day in the sun's place for every 240 years; which principal error, in

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ſo fundamental a point, does vitiate the whole ſuperſtructure of the almageſt, and ſeems to convict its author either of want of diligence, or fidelity, or both.

But to return to our method; the great advantage we have hereby, is, that any very high building ſerves for an inſtrument, or the top of any high tower, or ſteeple, or even any high wall whatever, that may be ſufficient to intercept the ſun, and caſt a true ſhadow; nor is the poſition of the plane, on which you take the ſhadow, or that of the line therein, on which you meaſure the receſs of the ſun from the *Tropic*, very material; but in what way ſoever you diſcover it, the ſaid receſs will be always in the ſame proportion, by reaſon of the ſmallneſs of the angle, which is not ſix minutes in the firſt five days; nor need you enquire the height or diſtance of your building, provided it be very great, ſo as to make the ſpaces, you meaſure, fair and large. But it is convenient, that the plane, on which you take the ſhadow, be not far from perpendicular to the ſun, at leaſt, be not very oblique; and that the wall, which caſts the ſhadow, be ſtreight and ſmooth at top, and its direction nearly eaſt and weſt; and it will be requiſite to take the extreme greateſt or leaſt deviation of the ſhadow of the wall, becauſe the ſhadow continues for a good time at a ſtand, without alteration, which will afford the obſerver leiſure to be aſſured of what he does, and not be ſurpriſed by the quick tranſient motion of the ſhadow of a ſingle point at ſuch a diſtance. The principal objection is, that the penumbra, or partile ſhadow of the ſun, is in its extremes very difficult to diſtinguiſh from the true ſhadow, which will render this obſervation hard to determine nicely; but if the ſun be tranſmitted thro' a teleſcope, in the uſual manner of taking his ſpecies in a ſolar eclipſe, and the upper half of the object-glaſs be cut off by a paper paſted thereon, and the exact upper limb of the ſun be ſeen juſt emerging out of, or rather touching the ſpecies of the wall (the poſition of the teleſcope being regulated by a fine hair extended in the *Focus* of the eye-glaſs) the limits of the ſhadow may be obtained to the utmoſt exactneſs; and by this method the winter ſolſtice may be more certainly had than the ſummer, becauſe the ſame gnomon affords a much larger radius for this manner of obſervation.

The probable Causes of the Pain in Rheumatisms; *and the Suppression of* Urine, *cured by Acids; by Dr.* Baynard. Phil. Trans. N° 215. p. 19.

DR. *Baynard* was always of opinion, that the pains in a rheumatism were not caused by any saline or acid particles in the blood, *&c.* but rather from its clammineſs and denſity diſtending the veſſels thro' which it paſſes, which diſtenſion produces thoſe ſharp and pungent pains, which rheumatick patients ſo generally complain of; for although the proper coats of the veins and arteries ſeem to be inſenſible in themſelves, yet thoſe thin membranes, which beſet them, are of a moſt exquiſite ſenſe, and full of lymphæducts, which being dilated and ſtretched, cauſe an inflamatory ſymptomatical fever, with continual ſweats, the blood being glutinous and ſizy, as in quinſies and pleuriſies, and all other inflamatory diſtempers; the fever is increaſed by the great quantity of alcalical corroſive ſalts, lodging in the blood, cauſing thirſt, *&c.* and not diluted and waſhed off by urine, which is always thick, turbid and high coloured, and almoſt, if not wholly, devoid of any ſaline impregnations. To prove which, he ſent ſix quarts of a ſtrong man's urine, in the height of a rheumatiſm, to that ingenious artiſt Mr. *George Moult*, who chemically analiſed it, found not above the 30th part of thoſe ſalts, uſually found in ſuch a quantity of the urine of a ſound perſon.

A patient had laboured for ſeven or eight days under a total ſuppreſſion of urine; upon trying with the catheter, there was not the leaſt appearance of a ſtone, nor a drop of water in his bladder; whereupon, Dr. *Baynard*, ſuppoſing it might be the ſame caſe of which the learned Dr. *Wilkins* died, cauſed the patient to take a quantity of acids in a convenient vehicle; upon which, ſecretion being preſently made, there was a great diſcharge of urine, and he was thereby reſtored to his health; and acids were found to be of ſervice to other patients that laboured under ſuppreſſions of urine.

The Bones *of a* Skeleton *united without Articulation or Cartilage; by Dr.* Bern. Connor. Phil. Trans. N° 215. p. 21.

DR. *Connor* had ſeen in *France* part of a human ſkeleton, conſiſting of the *Os Ilium*, *Os Sacrum*, the five *Vertebræ* of the loins, 10 of the back, 5 entire ribs on the right ſide, and three on the left; the extremities of the other were cloſely united to the tranſverſe apophyſes of their *Vertebræ*. All theſe bones, which

which are naturally distinct from each other, were here so straightly and intimately conjoined, their ligaments so perfectly bony, and their articulations so effaced, that they really made but one uniform continuous bone; the roots of all the ribs made but one equal smooth and plain surface with the *Vertebræ* and their apophyses; the oblique apophyses of all the *Vertebræ*, were so confounded and lost, that it was not possible to observe any marks of them; the cartilaginous edge of the *Vertebræ* themselves was become perfect bone. Upon sawing two of the *Vertebræ* asunder at the commissure, this uniting of their parts did not enter above two lines deep, and their middles were separated, as they usually are, and touched each other only at the edges; on the left side at half a fingers breadth from the *Vertebræ*, two ribs were joined together for the space of an inch, and afterwards ran separated and parallel, like the rest, to the *Sternum*. The figure of this trunk was crooked, making partly a circle, the *Spinæ* forming the convex, and the inside of the *Vertebræ*, the concave part of this segment; the direction of the ribs was unnatural; for instead of terminating at the *Sternum* in parallel semicircles, nearly horizontal, their extremities, where they reached the *Sternum* inclined so much towards the *Hypogastrium*, as to touch the sides of the *Ossa ilium*. This trunk seemed to be of a grown person, the bones being of a proportion and thickness equal to those of old men; the *Vertebræ* of the loins were larger than those of the back, as they naturally are; there was no unnatural bunching out; they were conjoined together very regularly, no one *Vertebra* standing out beyond the other, either before, behind, or on the sides; the cavity for the spinal marrow had no other fault than its crooked figure; the bones of the *Os Pubis* were separated as usual; the socket or cavity of the last spurious rib on the right side, being smooth and polished, seemed as if that rib had not been so firmly united as the rest.

From this construction of the parts, it necessarily follows, that the body of this person must have been immoveable; that he could neither bend, or stretch himself out, neither rise up, or lie down, nor turn upon his side, having only the head feet and hands moveable. If it be objected, that respiration could not be performed, when the ribs were thus immoveable, this difficulty may be obviated by observing how little motion of the breast is necessary to continue the circulation of the blood thro' the lungs, as is visible in hysterick fits, *&c.* Again, the ribs of this skeleton, tho' fixed at the centre, might yet be moved at the extremities, and so the thorax be enlarged by a much less force than that of the muscles used for that purpose; besides, the diaphragm, the

chief organ of reſpiration, was in this ſubject free in its actions. But it is likely this perſon breathed very ſhort, the quickneſs of the returns ſupplying the defect of a large draught of air at once; and poſſibly the *Foramen Ovale* might continue open, and by it and the *Canalis Arterioſus* the blood might paſs from the *Cava* to the *Aorta*, and but a part of it paſs thro' the lungs.

A Water-ſpout; *by Mr.* Zach. Maine. Phil. Tranſ. N° 215. p. 28.

THESE appearances are frequent abroad, but very ſeldom or never to be ſeen with us, tho' ſome pretend to have ſeen them in the *Downs*; the *French* call them *Trombes*, poſſibly from their figure, and the noiſe they make, that term ſignifying a kind of *Humming Top*; they are certain elevations of water, during ſtorms and tempeſts, reaching from the ſurface of the ſea to the clouds; they happen ſeveral ways; ſometimes the water is ſeen to boil, and raiſe it ſelf for a conſiderable ſpace round, about a foot from the ſurface; above which appears, as it were, a thick and black ſmoke, in whoſe middle is obſerved a ſort of ſtream or pipe, reſembling a tunnel, which riſes as high as the clouds, at other times theſe pipes or tunnels are obſerved to come from the clouds, and ſuck up the water with great noiſe and violence; they move from the place where they were firſt collected, according to the motion of the wind, and diſcharge themſelves ſometimes into the ſea, to the unavoidable deſtruction of ſuch ſhips, as are in their way, if they be ſmall veſſels, and to the endamaging even of large ſhips; ſometimes they fall on the ſhore, beating down all they meet with, and raiſing the ſand and ſtones to a prodigious height; uſually guns are fired at them loaded with a bar of iron; and if they are ſo happy as to ſtrike them, they preſently diſcharge their water with a mighty noiſe, without any farther miſchief.

A Propoſition of general uſe in Gunnery; *by Mr.* Edm. Halley. Phil. Tranſ. N° 216. p. 68.

IT was formerly the opinion of thoſe concerned in artillery that there was a certain requiſite of powder for each gun, and that in mortars where their diſtance was to be varied, it muſt be done by giving a greater or leſſer elevation to the piece; but now our later experience has taught us, that the ſame thing may be more certainly done and readily performed, by increaſing and diminiſhing the quantity of powder, whether regard be had to the execution to be done, or to the charge of doing of it; for when bombs are diſcharged with great elevations of the mortar, they fall too perpendicular, and bury themſelves too deep in the ground,

ground, to do all that damage they might, if they came more oblique, and broke upon, or near the ſurface of the earth; which is a thing acknowledged by the beſieged in all towns, who unpave their ſtreets, to let the bombs bury themſelves, and thereby they ſtifle the force of their ſplinters. A ſecond convenience is, that at the extreme elevation, the gunner is not obliged to be ſo curious in the direction of his piece, but it will ſuffice to be within a degree or two of the truth; whereas, in the other method of ſhooting, he ought to be very cautious. But a third and no leſs conſiderable advantage is, in the ſaving of the king's powder, which in ſo great and ſo numerous diſcharges, muſt needs amount to a conſiderable value; and for ſea mortars it is ſcarcely practicable otherwiſe to uſe them, where the agitation of the ſea continually changes the direction of the mortar, and would render the ſhot very uncertain, were it not that they are placed about 45° elevation, where ſeveral degrees above or under, make very little difference in the effect.

When Mr. *Halley* gave the ſolution of this problem; *viz.* to hit an object, above or below the horizontal line, with the greateſt certainty, and leaſt force; he was not then aware, that the elevation there ſought did conſtantly biſect the angle between the perpendicular and the object, as is demonſtrated from the difference and ſum of the tangent and ſecant of any arch, being always equal to the tangent and co-tangent of the half complement thereof, to a quadrant; but having diſcovered this, he thinks nothing can be more compendious, or bid fairer to compleat the art of gunnery; it being as eaſy to ſhoot with a mortar at any object, on demand, as if it were on the level; neither is there need of any computation, but only ſimply laying the gun in the middle line, between the zenith, and the object, and giving it its due charge; nor is there any great need of inſtruments for this purpoſe; for if the muzzle be turned truly ſquare to the bore of the piece, as it uſually is, or ought to be, a piece of looking-glaſs plate, applied parallel to the muzzle, will, by its reflection, give the true poſition of the piece, the bombardeer having no more to do, but to look perpendicularly down on the looking-glaſs along a ſmall thread with a plummet, and to raiſe or depreſs the elevation of the piece, till the object appear reflected on the ſame point of the *Speculum*, on which the plummet falls; for the angle of incidence and reflection being equal, in this caſe a line at right angles to the *Speculum*, as is the axis of the chaſe of the piece, will biſſect the angle between the perpendicular and the object, according as the propoſition requires.

Prob. 1. A ſhot being made on an inclined plane, having the horizontal diſtance of the object it ſtrikes, with the elevation of the piece, and the angle at the gun, between the object and the perpendicular; to find the greateſt horizontal range of that piece, loaded with the ſame charge; that is, half the *Latus Rectum* of all the parabolæ made with the ſame impetus.

Take half the diſtance of the object from the *Nadir*, and take the difference of the given elevation from that half; the verſed ſine of twice that difference, ſubſtract from the verſed ſine of the diſtance of the object, from the zenith; then will the difference of thoſe verſed lines, be to the ſine of the diſtance of the object from the zenith, as the horizontal diſtance of the object ſtruck to the greateſt horizontal range, at 45°.

Prob. 2. Having the greateſt horizontal range of a gun, the horizontal diſtance, and angle of inclination of an object to the perpendicular; to find the two elevations neceſſary to ſtrike that object.

Halve the diſtance of the object from the *Nadir*; this half is always equal to the half ſum of the two elevations ſought; then ſay, as the greateſt horizontal range is to the horizontal diſtance of the object, ſo is the ſine of the angle of inclination, or diſtance of the object from the perpendicular, to a fourth proportional; which fourth being ſubſtracted from the verſed ſine of the diſtance of the object from the zenith, leaves the verſed ſine of the difference of the elevations ſought; which elevations are therefore had, by adding or ſubſtracting that half difference to and from the aboveſaid half ſum.

It only remains, by good and valid experiments, to be aſſured of the force of gun-powder; how to make and conſerve it equal; and to know the effect thereof in each piece; that is how far different charges will caſt the ſame ſhot; which may moſt conveniently be ingraven on the outſide thereof, as a ſtanding direction to all gunners, who ſhall from thenceforward have occaſion to uſe that piece. And were this matter well aſcertained, it might be worth the while to make all mortars of the like diameter, as near as poſſible alike in length of chaſe, weight, chamber, and all other circumſtances.

An Account of Tadmor; *by Mr.* Will. Halifax. Phil. Tranſ. N° 217. p. 83.

FROM *Aleppo* to *Tadmor* are ſix days eaſy journey, over a deſart country; as you ride into the town, there is a caſtle about half an hours diſtance from it, and ſo ſituated as to command

command both the pass into the hills, by which the town is entred, and the city too; but it was easily seen, that it was no ancient building, retaining no footsteps of the exquisite workmanship and ingenuity of the ancients. Upon enquiry, it was said to be built by *Man-ogle*, a prince of the *Druces*, in the reign of *Amurath* the third, *A. D.* 1585; but it does not appear that either *Man-ogle*, or any *Drucian* prince, was ever powerful in these parts, their strength lying on mount *Libanus*, and along the coast of *Sidon*, *Berytus*, &c. It is a work of more labour than art, and the very situation alone is sufficient to render it almost impregnable; it stands on the top of a very high hill, enclosed with a deep ditch, cut out of the very rock, over which there was only one passage alone by a draw-bridge, which is now broken down; so that there is no entry remaining, unless you will be at the pains to clamber up the rock, which may be done in one place, but with such difficulty and hazard, that the least slip endangers a man's life; nor is there any thing to be seen within it sufficient to recompense the trouble of getting up to it, the building being confused, and the rooms very ill contrived; upon the top of the hill there is a well of a prodigious depth. This castle stands on the north side of the town, and from hence you have the best prospect of the country all round; you see *Tadmor* below you enclosed on three sides with long ridges of mountains, which open gradually towards the east to the distance of about an hour's riding; but to the south there extends a vast plain beyond the reach of the eye; in which is a large valley of salt, at about an hour's distance from the city; and this is more probably the valley of salt, mentioned 2. *Sam. c.* 8. *v.* 13, where *David* smote the *Syrians*, and slew 18000 men, than another, which lies about 4 hours from *Aleppo*, and has sometimes passed for it. The air is good, but the soil exceeding barren, nothing green to be seen therein, save a few palm-trees in the gardens, and here and there about the town; and from them, it probably had its name, both *Tadmor* and *Palmira*, and the whole country thence denominated *Syria Palmirena*, and sometimes *Solitudines Palmirenæ*; so that the *Latins* did not change but only translate the old name, which therefore still obtains in these eastern parts, and the more modern is wholly unknown; the city itself appears to have been of a large extent, by the space now taken up by its ruins; but there are no foot-steps of any walls remaining, nor is it possible to judge of the ancient figure of the place. The present inhabitants as they are poor, so they have shut themselves up, to the number

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of about 30 or 40 families, in little huts made of dirt, within the walls of a ſpacious court, which encloſed a moſt magnificent heathen temple; the whole ſpace is a ſquare of 220 yards each ſide, encompaſſed with a high and ſtately wall, built of large ſquare ſtone, and adorned with pilaſters, within and without, to the number of 62 on a ſide; and had not the barbarity of the *Turks*, who are enemies to every thing that is noble and ſplendid, out of a vain ſuperſtition, purpoſely beat down thoſe beautiful corniches, perhaps the world could not boaſt of more curious and exquiſite carvings, as was abundantly plain from ſome remaining fragments; the weſt ſide, on which is the entry, is moſt of it broken down, and near the middle of the ſquare, another higher wall is raiſed out of the ruins, which appears to have been a ſtrong but rude caſtle; within were to be ſeen the foundations of another wall, which probably might anſwer the front; and it is probable the *Mamalukes*, whoſe workmanſhip it appears to have been, built the caſtle here for the ſecurity of the place. Before the whole length of this new front, except a narrow paſſage, which is left for an entry, there is cut a deep ditch, the aſcent whereof on the inſide is faced with ſtone to the very foot of the wall, which muſt have rendred it very difficult to be aſſaulted; the paſſage, and the door itſelf is very narrow, not wider than to receive a loaded camel, or two men a breaſt; and as ſoon as you are within the firſt door, you make a ſhort turn to the right, and paſs on to another of the like bigneſs, which leads into the court; this outward wall quite ſhrouds that magnificent entry, which belonged to the firſt fabric; of the ſtateline's of which we may judge by the two ſtones, which ſupport the ſides of the great gate, each of which is 35 foot in length, and artificially carved with vines and cluſters of grapes, exceedingly bold and to the life; they are both ſtanding, and in their places; and the diſtance between them, which gives the wideneſs of the gate, is 15 foot; but all this is now walled up to the narrow door abovementioned; over the ſmall door is an inſcription in *Greek*, and alſo another in a different language and character, which Mr. *Halifax* never ſaw till then, nor could he make any thing of it; from that in *Greek*, it will be evident, that the ſtone was brought from another place, and caſually put in there; and it is as follows;

ΤΟ ΜΝΗΜΕΙΟΝ ΤΟΥ ΤΑΦΕωΝΟϹ ΕΚΤΙϹΕΝ ΕΞ ΙΔΙωΝ ϹΕΠΤΙΜΙΟϹ ΟΔΑΙΝΑΘΟϹ Ο ΛΑΜΠΡΟΤΑΤΟϹ ϹΥΝΚΛΗΤ [ΙΚΟϹ] ΑΙΡΑΝΟΥ ΤΟΥ ΑΒΔΛΔΑΘΟΥ ΤΟΥ ΝΑϹωΡΟΥ ΑΥΤω ΤΕ ΚΑΙ ΥΙΟΙϹ ΑΥΤΟΥ ΚΑΙ ΥΙωΝΟΙϹ ΕΙϹ ΤΟ ΠΑΝΤΕΛΑΕϹ ΑΙωΝΙΟΝ ΤΕΙΜΗΝ.

Under

Under this was the unknown character, which being added almoſt to every *Greek* inſcription, makes it probable that it was the native language and character of the place, and its ſubject the ſame with what we have in *Greek*; the letters between theſe [ ] marks were not legible, nor was the E in MN EION upon the ſtone, being doubtleſs omitted by miſtake; and the inſcription is nothing other than that of a ſepulchre.

As ſoon as you are entred within the court, you ſee the remains of two rows of very noble marble pillars, 37 foot high, with their capitals of moſt exquiſite carved work; of theſe only 58 remain intire, but there muſt have been a great many more, for they appear to have gone quite round the whole court, and to have ſupported a very ſpacious double piazza or cloiſter. The walks on the weſt ſide of this piazza, which is oppoſite to the front of the temple, ſeem to have exceeded the other in beauty and ſpaciouſneſs; and at each end thereof are two niches for ſtatues at their full length, with their pedeſtals, borders, ſupporters and canopies, carved with the greateſt art and curioſity. The ſpace within this once beautiful encloſure, which is now filled with nothing but the dirty huts of the inhabitants, ſeems to have been an open court, in the middle whereof ſtands the temple, encompaſſed with another row of pillars of a different order, and much taller than the former, being about 50 foot high; of which only 16 remain. The whole ſpace, contained within theſe pillars, was 59 yards in length and nearly 28 in breadth; in the middle of which ſpace is the temple, extending in length more than 33 yards, and in breadth 13 or 14. It points north and ſouth, with a moſt magnificent entry on the weſt, exactly in the middle of the building, which, by the ſmall remains thereof, ſeems to have been one of the moſt glorious ſtructures in the world; never were vines and cluſters of grapes cut in ſtone in ſo bold, ſo lively and ſo natural a manner; juſt over the door, one may diſcern part of the wings of a large ſpread-eagle, extending its whole width; whoſe largeneſs at firſt made Mr. *Halifax* imagine it might have been rather a cherub overſhadowing the entry, there being nothing of the body remaining to guide one's judgment; and ſome little angels or cupids appear ſtill in the corners of the ſame ſtone; but afterwards, ſeeing other eagles on ſtones that were fallen down, he concluded this muſt have been one likewiſe, only of a much larger ſize. Of this temple only the outward walls remain ſtanding, in which it is obſervable, that as the windows were not large, ſo they were made narrower towards the top than they were below, but all adorned with excellent carvings. Within the walls, the *Turks*

or

or more probably the *Mamalukes*, have built a roof, ſupported by ſmall pillars and arches; but a great deal lower, as well as in other reſpects diſproportionate, and inferior to what the ancient covering muſt have been; and they have converted the place into a moſque, adding to the ſouth end thereof new ornaments after their manner, with *Arabic* inſcriptions and ſentences out of the *Alcoran*, written in flouriſhes and wreaths, not without art; but at the north end of the building, which makes no part of the moſque, are reliques of much greater art and beauty; they are beautified with the moſt curious fretwork and carvings; in the middle of this is a dome or cupola, about 6 foot diameter, and above, of one piece, either hewn out of one entire rock, or made of ſome artificial cement or compoſition, hardened by length of time into a ſtony ſubſtance; in a word, it is a moſt exquiſite piece of workmanſhip. Upon paſſing by the ruins of a handſome moſque, Mr. *Halifax* had the proſpect of ſuch magnificent ruins, that if one may frame a conjecture of the original beauty of that place, by what is ſtill remaining, it may be queſtioned, whether any city in the world could have vied with it in magnificence. Advancing towards the north, you have before you a very tall and ſtately obeliſk, or pillar, conſiſting of 7 large ſtones, beſides its capital, and the wreathed work about it; the carvings here, as in all other places, are extraordinary fine; its height is above 50 foot, and probably there ſtood a ſtatue upon it, which the *Turks*, zealous enemies to all imagery, have thrown down and broken in pieces; it is in compaſs, juſt above the pedeſtal, 12 foot and a half; on each hand of this, towards the eaſt and weſt, two other large pillars are ſeen, each a quarter of a mile diſtant, and a piece of another towards the eaſt, which would incline one to think there was once a continued row of them; the height of that to the eaſt was above 42 foot, and the circumference proportionable; Upon its body is the following inſcription;

Η ΒΟΥΛΗ ΚΑΙ Ο ΔΗΜΟϹ ΑΛΙΛΑΜΕΝΑ ΠΑΝΟΥ ΜΟΚΙΜΟΥ ΤΟΥ ΑΙΡΑΝΟΥ ΤΟΥ ΜΑΘΘΑ ΑΙΡΑΝΗΝ ΤΟΝ ΠΑΤΕΡΑ ΑΥΤΟΥ ΕΥϹΕΒΕΙϹ ΚΑΙ ΦΙΛΟΠΑΤΡΙΔΑϹ Κ[ΑΙ] ΠΑΝΤΙ ΤΡΟΠΩ[ΕΥ]ϹΕΙΜΩϹ ΑΡΕϹΑΝΤΑϹ ΤΗ ΠΑΤΡΙΔΙ ΚΑΙ ΠΑΤΡΙΟΙϹ ΘΕΟΙϹ ΤΕΙΜΗϹ ΧΑΡΙΝ ΕΤΟΥϹ ΝΤΑ ΜΗΝΟϹ ΞΑΝΔΙΚΟΥ.

It ſeems evident from this and ſome following inſcriptions, that they were a free ſtate, governed by a ſenate and people, tho' perhaps under the protection of greater empires, as firſt the *Parthians*, and afterwards the *Romans*, who for a long time contended for the maſtery here in the eaſt; and this government might

might continue amongſt them, till about the time of *Aurelian*, who demoliſhed the place, and led *Zenobia*, wife of *Odenatus*, captive to *Rome*; who, tho' ſhe be called queen, yet we do not find that ever her husband had the title of king, but was only one of the chief inhabitants, a leading man in the ſenate, as it is probable theſe *Alilamanes* and *Airanes* were before him, who whilſt the *Romans* were buſied in *Europe*, made himſelf great here, and by his own force repelled the *Parthians*; who, having made themſelves maſters of whatever the *Romans* poſſeſſed on the other ſide of *Euphrates*, made an incurſion into *Syria*, but were driven back beyond the river by *Odenatus*. In the courſe of theſe wars *Odenatus* was ſlain, but his wife *Zenobia*, being a woman of a maſculine ſpirit, not only maintained her ground againſt her enemies abroad, but preſerved her authority at home, keeping the government in her own hands. Afterwards out of a deſire to caſt off the *Roman* yoke, ſhe cauſed the whole garriſon, left there by *Aurelian*, to be barbarouſly cut off, which bringing *Aurelian* back with his army, he quickly took the city and deſtroyed it, putting the inhabitants to the ſword, and carrying *Zenobia* captive to *Rome*; which was the fatal period of the glory of that place. This method of running up their genealogies or pedigrees to the 4th or 5th generations, ſhews that they borrowed ſome of their cuſtoms from their neighbours the *Jews*, with whom it is not improbable they had formerly great commerce; and perhaps many of them were deſcended from that people, *Zenobia* herſelf being ſaid to have been a *Jeweſs*; or elſe this muſt have been the manner of all the eaſtern nations. Their *Æra*, or account of time, they begin from the death of *Alexander the Great*, as the *Syrians* generally do, and the very Chriſtians at this day follow the ſame uſage. Yet, tho' they denote the date of the year by *Greek* characters, they range them a different way from the *Greeks*, ſetting the leſſer number firſt, as if they were to be read backwards from the right hand to the left, NT here denoting 450; the third letter A Mr. *Halifax* takes to ſtand for the day of the month; *viz.* the laſt of *Xandicus*, which anſwers to our *April*; this and other names of months, which are found in other inſcriptions, are borrowed from the *Macedonians*, with very little variation. That they were idolaters is plain by the mention made of their country gods, both here and in other places; ſo that their commerce with the *Jews* did not, it ſeems, bring them to the knowledge of the true God; or elſe, they muſt have degenerated therefrom, and relapſed into idolatry.

Proceeding forwards directly from the obeliſk, about 100 paces, you come to a magnificent entry, vaſtly large and lofty, and for the exquiſiteneſs of the workmanſhip not inferior to any thing before deſcribed; this entry leads into a noble piazza, above half a mile in length, and 40 foot in breadth, encloſed with two rows of ſtately marble pillars, 26 foot high, and 8 or 9 foot in compaſs; of theſe there remain ſtanding and entire 129, but by a moderate calculation, there could not have been leſs than 560. The upper end of this ſpacious piazza was ſhut in by a row of pillars, ſtanding ſomewhat cloſer than thoſe on each ſide; and perhaps there might have been a kind of banqueting-houſe above; but a little farther to the left hand, are the ruins of a very ſtately building, which one may be apt to believe might have been allotted for ſuch an uſe; it is built of a better marble, and hath an air of delicacy and exquiſiteneſs in the work beyond what is diſcernible in the piazza; the pillars, which ſupported it, are of one entire ſtone; and one of them that was fallen down, but ſo firm and ſtrong as to receive no injury thereby, meaſured 22 foot in length, and 8 foot 9 inches in compaſs. In the weſt ſide of the great piazza, are ſeveral apertures for gates, leading into the court of the palace; two whereof, one would eaſily believe, when they were in their perfection, were the moſt magnificent and glorious in the world, both for the elegancy of the work in general, and particularly for thoſe ſtately porphyry pillars, with which they were adorned; each gate had four of them, not ſtanding in a line with the others of the wall, but placed by couples in the front of the gate, facing the palace, two on one hand, and two on the other; of theſe only two remain entire, and but one ſtanding in its place; they are about 30 foot in length, and 9 in circumference; of a ſubſtance ſo exceeding hard, that it was with great difficulty a piece could be broken off; but now the art of making them is quite loſt. The palace itſelf is ſo entirely ruined, that no judgment can be made what it was in its ancient ſplendor, either for the figure or workmanſhip thereof.

Hot ſulphureous baths are things very frequent in this country; and hence it is, that it obtained the name of *Syria Salutifera*; the ſcent of the waters here is much like thoſe of *Bath* in *England*, but not ſo ſtrong, nor the taſte ſo offenſive; on the contrary, when they have run ſo far from the fountain, as to become cold, they are very potable, and are the only water the inhabitants uſe.

On the eaſt ſide of the long piazza ſtands a vaſt number of marble pillars, ſome perfect, and others deprived of their beautiful

tiful capitals; but ſo ſcattered and confuſed, that it is not poſſible to reduce them to any order, ſo as to enable one to conjecture what purpoſe they anciently ſerved; in one place are 11 ranged together in a ſquare, paved at the bottom, with broad flat ſtone, but without any roof or covering; and at a little diſtance from that ſtand the ruins of a ſmall temple, which by its remains ſeems to have been of curious workmanſhip; but the roof is entirely gone, and the walls are very much defaced and conſumed by time; before the entry, which looks to the ſouth, is a piazza ſupported by 6 pillars, two on one hand of the door, and two on the other, and one at each end; and the pedeſtals of thoſe in the front have been filled with inſcriptions, both in *Greek* and the other unknown language; but they are now ſo obliterated and worn out, as not to be intelligible.

The ſepulchres there are very curious, being ſquare towers 4 or 5 ſtory high, and ſtanding on both ſides of a hollow way, towards the north part of the city; they extend in length the ſpace of a mile, and perhaps anciently they might ſtretch out a great way farther; they were all of the ſame form, but of different ſplendor and greatneſs, according to the circumſtances of their founders. There were two ſepulchres, which were more entire than the reſt, tho' not without marks of the *Turkiſh* fury; they were two ſquare towers, rather larger than ordinary ſteeples, and 5 ſtory high, the outſide being of common ſtone, but the partitions and floors within of good marble, and beautified with very lively carvings, paintings, and figures both of men and women, as far as the breaſts and ſhoulders, but miſerably defaced and broken; under theſe ſtatues or by their ſides, are, in the unknown character, the names probably of the perſons there buried. One of theſe monuments had a door on the ſouth ſide, from which was a walk croſs the whole building juſt in the middle; but the floor was broken up, and ſo afforded a view of the vault below, divided after the ſame manner; the ſpaces on each hand were again ſubdivided into 6 partitions by thick walls; each partition being capable of receiving the largeſt corps; and piling them one above another, as their way appears to have been, each of thoſe ſpaces might contain at leaſt 6 or 7 bodies; in the loweſt, ſecond and third ſtories, theſe partitions were uniform, and altogether the ſame, ſave that from the ſecond floor, which anſwered the main entry, one partition was reſerved for a ſtair-caſe; higher than this, the building being ſomething contracted towards the top, it would not afford ſpace for the continuation of the ſame

method; therefore the two uppermoſt rooms were not ſo divided, nor perhaps had ever any bodies laid in them, unleſs that of the founder alone, whoſe ſtatue, wrapped up in his ſhroud, and in a lying poſture, was placed in a niche, or rather window, in the front of the monument, ſo as to be ſeen both within and without; near to this ſtatue was the following inſcription,

ΤΟ ΜΝΗΜΕΙΟΝ ΕΚΤΙϹΑΝ ΕΛΑΒΗΛΕϹ ΜΑΝΝΑΙΟϹ ϹΟΧΑΕΙϹ ΜΑΛΧΟϹ ΟΥΑΒΑΛΛΑΘΟΥ ΤΟΥ ΜΑΝΝΑΙΟΥ ΤΟΥ ΕΛΑΒΗΛΟΥ ΑΥΤω ΚΑΙ ΥΙΟΙϹ ΕΤΟΥϹ ΔΙΥ ΜΗΝΟϹ ΞΑΝΔΙΚΟΥ.

It is a little doubtful, whether ΑΥΤω ſhould not rather be made ΑΥΤΟΙϹ, or elſe there muſt be a fault in the verb, and all thoſe but the names of one perſon.

The other monument was very like this, only the front and entry were towards the north, and it was not altogether ſo exquiſite, nor ſo well painted, but the carvings were as good, and it ſhewed altogether as ſtately and magnificent as the former; beſides, it had the advantage in age of a whole century of years, as appears from the date of the following inſcription; it is placed above a niche in the front, adorned with handſome borders and corniches; doubtleſs the place of ſome ſtatue, and probably that of the founder.

ΜΝΗΜΕΙΟΝ ΑΙωΝΙΟΝ ΓΕΡΑϹ ωΚΟΔΟΜΗϹΕΝ ΓΙΧΟϹ ΜΟΚΙΜΟΥ ΤΟΥ ΚΑΙΑΚΙΑΛΛΙϹΟΥ ΤΟΥ ΜΑ..... ΟΥ ΕΙΚΤΕ ΕΑΥΤΟΝ ΚΑΙ ΥΙΟΥϹ ΚΑΙ ΕΓΓΟΝΟΥϹ ΕΤΟΥϹ ΔΙΥ ΜΗΝΕΙ ΞΑΝΔΙΚω.

This is the moſt ancient inſcription Mr. *Halifax* met with in *Tadmor*, the 314th year from the death of *Alexander the Great*, preceeding the birth of our Saviour about 10 years; the other inſcription is alſo 20 or 30 years before the reign of *Hadrian*, and conſequently before the *Romans* got footing here; and from theſe ſumptuous ſtructures, and theſe coſtly *Mauſolea* we may reaſonably conclude, they were a potent and opulent people before they became ſubject to the *Romans*, and were not obliged to them for their greatneſs.

A Voyage

A Voyage *of some* Engliſh Merchants *at* Aleppo *to* Tadmor. Phil. Tranſ. N° 218. p. 129.

JULY 18th, 1678, at 5 o'clock in the morning, theſe merchants ſet out from *Aleppo*, with 40 ſervants and *Mulettier's* in all, and in four hours and a half, traveling ſouth by eaſt, they arrived at a village called *Cafferabite*, being at the edge of the deſart; *July* 19th, they roſe at one in the morning, and directed their courſe S. S. E. over the deſart, towards a fountain called *Churraick*; but their guide loſing his way, and there being no path, it was near noon before they found it; here they pitched their tents, and refreſhed themſelves and horſes; the water is of a purgative quality; in their way they found two *Arabs* with two aſſes, one whereof carried water and a little bread, the other they rode on by turns; they had one gun, with which they ſhot gazels, the bullet being a hard ſtone, broken round, and caſed with lead; they had on the palms of their hands, elbows, knees and feet, ſome gazel-ſkin tied, that they might creep the better on the ground to ſhoot, one of the aſſes walking by as a ſtalking horſe, and the *Arab* imitating the cry of the gazel till he gets within ſhot of him; theſe *Arabs* are called *Selebee*. Whilſt the merchants continued at the weil, ſome *Arabs* came to them, that were making aſhes of the ordinary ſort of weeds called *Chuddraiſe*, *Ruggot*, and *Cuttaff*; theſe they cut and dry, and putting them into a pit, ſet fire to them, and the aſhes cake at the bottom; theſe they carry to *Eglib* and *Tripoli*, to make ſoap of; but the beſt ſort of aſhes are made of the weed *Shinon*, which grows about *Tadmor*, *Soukny*, *Tibe*, and *Tarecca*; it grows like broom in *England*, and in ſhape reſembles coral. *July* 20th, they roſe at 4 o'clock in the morning, and traveling two hours E. S. E. they arrived at *Andrene*, where they found the ruins of two or three churches, and of a great town lying in a large plain; where having tarried about an hour and a half, they took ſome fragments of *Greek* inſcriptions, which afforded no certain ſenſe, but yet were evidently *Chriſtian*; they marched again S. by E. and in about four hours time came to a pleaſant aqueduct, called *Scheck-alal*; this aqueduct is cut thro' the main rock, for a great way from the mountains; and where it ends, the *Arabs* have made a garden, which afforded melons, cucumbers, purſlain, *&c.* In a grotto hard by, there dwelt an *Arab* with his family; he had a dozen buffalo's, which they uſed both for their milk and to plow their ground, ſowing both

both wheat and barley; hitherto the *Arabs* resort, when they have committed any robbery about *Aleppo*, or *Hama*, and here they divide the spoil. *July* 21st, the merchants rose at 4 o'clock in the morning, and riding two hours southwards, they came to a ruinous place, called *Briadeen*; from hence going S. E. in four hours more they came to a well called *Costal*; most part of their way, thro' the desart, they were troubled with great numbers of rat-holes, like coney-boroughs, which, by the sinking in of the earth, very much discommoded their horses and mules; these rats have at the ends of their tails a bush of hair, and the *Arabs* eat them all, excepting one part; from this well they arose about four in the afternoon, and began to ascend small hills, covered with trees, which, for the most part, were the small pistacho's, which the *Arabs* pickle with salt, but eaten green are good to quench thirst; they travelled on for three hours up the hills, where they pitched that night, having no other water, but what they carried with them; and at night they had a small shower of rain, a thing unusual in that country at that time of the year. *July* 22d, they rose by two in the morning, and travelling E. S. E. they came to a well called *G'hor*. *July* 23d, they rose by one in the morning, and travelling for the most part to the east, they came to a large plain; and after proceeding in this plain for two or three hours, they espied an *Arab*, driving towards them his camel at full speed, so they suspected he had been sent as a spy; being come up to them, he told them he was of *Tadmor*, and that his prince, the *Emir Melkam*, had that day made friendship with *Hamet Shideed* another prince, and that together they had 400 men; so he kept company with the merchants for an hour or two, and enquired of their *Muleteers*, whether they were not *Turks* in disguise; for they travelled with a bandiero, the impress being a *Hanjarr*, or *Turkish* dagger, and a half-moon; and he could hardly believe they were *Franks*, wondering that they could thus travel in the desert out of mere curiosity; being once near to *Tadmor*, he went a little before them, and on a sudden run full speed towards the ruins; upon this the guide told the merchants, he was gone to acquaint the *Arabs* who they were, and that they ought to suspect and prepare for the worst; so they dismounted 20 of their servants, each having a long gun and pistol at his girdle, and placed them a breast before them, the merchants themselves on horseback, following at a small distance behind, with carabines and pistols;

piſtols; in this order they proceeded, and came to a moſt ſtately aqueduct, which runs under ground for five miles in a direct paſſage, and is covered with an arch of baſtard marble all the way, and there is a path on both ſides the channel for two perſons to walk a breaſt, the channel itſelf is about an *Engliſh* yard in breadth, and $\frac{3}{4}$ of a yard in depth; at 20 yards diſtance there are ventiducts all the way for air to paſs, and the holes are ſurrounded with ſmall mounts of earth, to keep the ſand and duſt from falling down; they marched cloſe by theſe mounts, which might ſerve them for a defence, expecting every mount the *Arabs* would come and attack them, as having the diſadvantage of ſun and wind in their faces; wherefore the merchants travelled hard to gain an eminence, where they might poſt themſelves advantagiouſly, and ſtop and repoſe a little, to conſider what was beſt to be done; the *Arabs* finding that they came on with this order and reſolution, thought it not fit to attack them; and thus the merchants gained the hill, from whence they could diſcern thoſe vaſt and noble ruins, having a plain like a ſea for extent, to the ſouthward thereof; here having refreſhed their men, and fetched a ſmall compaſs, they deſcended by the foot of a mountain, on which ſtands a large uninhabited caſtle; in this place two *Arabs* came to them with lances, one being *Chiah* to *Melkam*, and the merchants ſent two to meet them; the *Arabs* told them, that the *Emir* had underſtood of their coming, and had ſent them to acquaint the merchants, that he was their friend, and that all the country was theirs; the merchants ſent back with them their Janizary, and a ſervant to viſit the prince in his tents, which were in a garden; and in the mean time diſmounted at a watering place amidſt the ruins, but did not unload till their Janizary and ſervant returned with the *Emir's Teſſarr*, aſſuring them of friendſhip and protection, a writing which the *Arabs* were never known to violate before; with them there came alſo one belonging to the *Sheck* of the town, for whom the merchants had letters from *Uſeffe Aga* the *Emeen* of *Aleppo*; and he adviſed the merchants, for greater ſecurity, to pitch their tents under the town walls, in the ruins of a large palace, the wall ſtill ſtanding very high, the town within being but ſmall, and the houſes, excepting two or three, no better than hog-ſties; ſo they pitched in a deep ſandy ground, where they felt it exceeding hot; here they waited till 3 o'clock without eating any thing, expecting the *Sheck* would have made them preſents, according to the uſual cuſtom of the *Turks* to their friends,

friends, and have given ſome anſwer to the letters they brought him; but on the contrary, they found by the geſtures of the people, that they had reaſon to ſuſpect them; upon this, two of the merchant's company, believing that the want of a preſent to the *Emir* was the cauſe thereof, reſolved to venture on a viſit to him, and taking the Janizary and one ſervant, they carried him a preſent of two pieces of red cloath and four of green, and ſeveral other things; being come, he welcomed them to his tent, and placed the one on his right hand, and the other on his left; *Melkam* was a young man, not above 25, and of good features, and a moſt excellent horſeman; *Hamet Shideed*, the other prince, was more elderly, as about 40 years of age, and was not in the tent, but ſate under a palm-tree near it; he treated them with coffee, camel's fleſh and dates, and enquired of their journey, and the cauſe of their coming; they told him it was only curioſity to ſee thoſe ruins; he ſaid, that formerly *Solomon Ibn el Doud* built a city in that place, which, being deſtroyed, was built again by a ſtrange people, and he believed that the merchants, underſtanding the inſcriptions on the pillars, came in ſearch of treaſure, he having but ſix moons before found a pot of *Corra Cruſſes*; after this he went out of the tent, leaving them ſmoaking tobacco, and told the Janizary and ſervant, that never till then had any *Franks* been at that place, and that now they knew the way thro' the deſart, they might inform the *Turks* to their ruin and deſtruction, ſo that it would be convenient for them to deſtroy all the merchants; only that they coming as friends, he would have 4000 dollars as a preſent, elſe he would hang them and the two *Franks* up, and go fight the reſt; this meſſage being brought them, they wiſhed they could have excuſed themſelves from this embaſſy, and anſwered they could ſay nothing to that demand, not knowing the minds of the reſt, but if he would permit them to go and ſpeak with them, they would return an anſwer; upon this, he threatened preſent death, but at length gave leave to the Janizary to carry a letter to their companions, wherein they ſhewed the danger they were in, and the price ſet on them; *viz.* 4000 dollars, one half in money, and the other half in goods, as ſwords, cloths, tents, *&c.* which the *Emir* promiſed to value at their worth; upon this they made up in goods and money to the value of 1500 dollars which was all they could, and about ſun-ſet the *Emir* returned their two friends; and thus, on account of this uſage they could not view theſe ruins. As far as they could conclude from

from their journeys, and the position of the ways, taken by two good compasses, the distance of *Tadmor* from *Aleppo* is about 150 *English* miles, and the course S. S. E. or rather somewhat more southerly, considering the variation of the compass, which is above half a point to the west in these parts.

In a second voyage, they set out from *Aleppo* for *Tadmor* on *Michaelmas* day 1691, being in all 30 men well armed, having obtained a promise of security from *Assyne* the king of the *Arabs*, and one of his own people for a guide; this day their road pointed S. by E. and in four hours they came to a fountain called *Cophir-Abiad*, leaving *Old Aleppo* about an hour distant on the right hand; here they made but a short stay, and proceeded to a better fountain at the foot of a very high hill, covered with loose stones, the ruins of a village called *Broeder*, of which there was not one house remaining; after this, they advanced thro' a fertile open plain, to a place called *Emghir*, famous for the best wheat, that is brought to *Aleppo*; this they made their first stage; and mounting again in the morning about 5 o'clock, in less than an hour, they passed by an uninhabited village, called *Urghee*, their road pointing as before thro' the fruitful plain; but when they came to ascend the hills, where they entred the desart, and were to take their leave of mankind, at least of an inhabited country for several days, they had a troublesome passage over loose great stones, without any appearance of a road. Their guide had promised to conduct them thro' pleasant groves and forests, but no such thing appeared, unless you bestow that name on low withered shrubs that grew on the way; all the country is stored with gazels, the only food of a barbarous sort of people there, and who are no mean artists in their way; for they lie down behind the stones, and shoot them as they pass along; and tho' their guns are very ordinary, exceeding heavy and thick, with match-locks, yet they are such excellent marksmen, that they kill many of them. After this, they bent their course to the S. E. or something more easterly, and came to the side of a bog, called *Zerga*, where there was water enough, but neither palatable or wholesome. *October* 1st, they departed from *Zerga*, about two hours before sun-rising, and as soon as it was light, they had the prospect of a very high hill, which was to be the boundary of their journey that day, called *Esree*, and where they had excellent water; here they could discern the foundations of a spacious city; and a piece of a

thick wall, built of a chalky ſtone, was ſtill ſtanding; this they judged to be the remains of a caſtle ſituated on the ſide of the hill, ſo as both to defend and command the city; on the top of the hill, above the caſtle, ſtand the ruins of a fabrick, in appearance very ancient, built of a very hard ſtone, yet exceedingly worn by the weather; it is of an oblong figure, pointing nearly to the N. E. and S. W. with only one door on the eaſt end, which was once adorned with extraordinary good carvings, of which there are ſtill ſome remains; but the greateſt part is either wore away, or purpoſely defaced; and thoſe marks of ancient beauty that remain are obſcure and ſcarcely diſcernible; the outſide of the walls is beautified with pilaſters quite round, whoſe pedeſtals and capitals are regular and handſome; but the roof is fallen down, and within appears nothing either great or beautiful.

October 2d, they departed from *Eſree*, about an hour and a half after midnight, and in ſix hours and a half they arrived at two wells, 18 fathom and two foot deep, known by the name of *Imp Malcha Giub*; thro' the greateſt part of this ſtage, they had a broad-beaten way, and where that was not diſcernible, they directed themſelves, by a ridge of chalky hills, under which the wells lay; the water was exceeding bad, and of ſo noiſome a ſcent, that they could not endure it, ſo much as at their noſes. In their way hither they were ſhewn the true plant, which they burn for ſoap-aſhes, which has no leaves, but a ſoft juicy ſtalk, ſhooting into ſeveral branches, and ſomething reſembling ſamphire, only it is rounder than that; the aſhes in burning run into cakes, not much unlike the cinders of a forge, only they are heavier, and not ſo full of pores, nor ſo hard as they are; in the afternoon they proceeded on their voyage two hours and a half, to a place called *Almyrrha*, paſſing rather between, than over the hills; their journey hitherto had been altogether ſoutherly, and but a little varying to the eaſtward of due ſouth.

October 3d, They ſet out from *Almyrrha* between five and ſix in the morning, making to the point of a high ridge of mountains, thro' an uneven deſart way; they came to the aſcent in about four hours, which they found not difficult, and when they were on the top, they had an agreeable proſpect of the country; this mountain was covered on both ſides with great plenty of turpentine trees, which was a very pleaſing ſight, having ſeen little green in their whole journey; this tree grows very thick and ſhady, and it yields a ſmall round nut, of which oil is made; tho' ſome eat them, and account them as great a regalio as piſtaches; their outward huſk is green, and more oily than that of piſtaches, and within

within a very thin ſhell they have kernels, very much reſembling them, both in colour and reliſh. From this hill they had a tedious deſcent, and came at its foot into a narrow gut, winding this way and that, between the mountains; that paſſage ſeemed very long, hot and tireſome; their want of water however obliged them to proceed, whereof they now began to be in great neceſſity, eſpecially for their horſes and mules; about 2 o' clock in the afternoon a ſmall drizling rain, which they had for about half an hour, increaſed to a very plentiful ſhower, which put them upon producing all the veſſels they had to catch it, as it fell from the heavens, or ran down the ſkirts of their tents, their horſes at the ſame time greedily drinking it from the ground; but in leſs than half an hour their camp was in a manner afloat; the hollow guts they paſſed over, without the leaſt appearance of moiſture, were, by cataracts, which deſcended from the mountains, become rivers; tho' next morning all this great quantity of water was paſſed away, ſo that in about two hours riding they could hardly perceive there had been any rain at all: this memorable place is known by the name of *Al-wiſhal*.

October 4th, From *Al-wiſhal* they proceeded for *Tadmor*, their way lay ſouthwards, but the gut, in which they travelled, would not permit them to keep a direct courſe; however in about an hours time, they paſſed by *Autor* mountains, thro' a gut or paſſage, both whoſe ſides ſo directly anſwered to each other, that one would be apt to think, they had been ſeparated by art, for an entrance into the country; but almoſt as ſoon as they were well got within the open ſpace, they were obliged to aſcend another hill, and ſo their road continued over hills and valleys interchangeably all the way: They had hardly proceeded 4 hours, when they came to the brow of a rocky mountain, ſeparated from that whereon the caſtle of *Tadmor* ſtands, only by a narrow valley; in this hill there appeared ſome quarries of fine ſtone, which probably might afford materials for the curious buildings in the city, where they ſoon after arrived.

After having tired themſelves in roving from one ruin to another, and ſearching amongſt old ſtones; and more eſpecially, not thinking it ſafe to linger too long in a place, where the mountain *Arabs* might either fall upon them, or endeavour to intercept their return; therefore on *Thurſday*, *Oct.* 8th, about half an hour after four in the morning, they departed from *Tadmor*, being very well ſatisfied with what they had ſeen, and glad to have eſcaped ſo dreaded a place; but in other reſpects they regreted, that they were obliged to leave unobſerved a great many things,

which deſerved a more particular and curious inſpection. Their road lay almoſt due eaſt, or a little inclining to the north; and on the left hand a ridge of hills extended for a great ſpace, ſometimes about half an hour diſtant from the road, and ſometimes opening wider; theſe hills were ſaid to abound in rich veins of ſeveral metals, and they ſupplied all that vaſt quantity of marble, the remains whereof they had ſeen at *Tadmor*; to the right hand there lay a very barren plain, perfectly bare, and ſcarcely any thing green to be ſeen therein, ſave a few gourds; in about five hours and a half they came to a fountain near a village called *Tarrecca*.

October 9, From *Tarrecca* they ſet out early, and travelling N. E. or near that point, in ſeven hours they arrived at *Soukney*; the road was much like that of the preceeding day, lying over a barren plain, only they had hills on both ſides, and ſometimes at the diſtance only of half an hour from each other; the village has its name from the hot waters, which are of the ſame nature with thoſe at *Tadmor*.

October 10, Continuing their voyage ſtill to the N. E. or ſomething more eaſterly, it was but an eaſy ſtage to another village called *Tilbe*, ſo called from the goodneſs of the waters, which notwithſtanding were not ſo very extraordinary; they had the taſte, and were doubtleſs tinctured with the ſame mineral with thoſe of *Soukney* and *Tadmor*, tho' not ſo ſtrongly; this village is pleaſantly ſituated, and makes a good appearance as one approaches to it, the proſpect being improved by a well built ſteeple, on which the moſque adjoins, or rather the remains of a Chriſtian church, being built with ſome more beauty and art than are uſually found in *Turkiſh* fabricks. From hence they ſet out in the afternoon, and proceeded about 2 ½ hours farther, and they pitched at a fountain, called *Alcome*, but the water was not fit to be drank, being of the ſame nature with that of *Soukney*, and almoſt as warm.

October 11, From *Alcome* they ſet out about an hour and a half after midnight, directing their courſe more northerly; as ſoon as it became light, they found themſelves in a wild open deſart, the ground in ſome places being covered with a ſort of heath, and in others quite bare; nor had they travelled long after the ſun was up, before they diſcovered *Arſoffa*, by the help of a riſing ground; but it was after 10 o'clock before they reached it; and finding no water there, they were obliged to proceed forwards to the river *Euphrates*, which is four hours diſtant from it. *Arſoffa* or as the *Arabs* call it *Arſoffa Emir*, ſeems to be the remains

remains of a monaſtry, being one continued pile of building, of an oblong form, ſtretching lengthwiſe eaſt and weſt, and encloſing a very ſpacious area; at a diſtance it makes a glittering ſhew, being built of *Gypſine Stone* or *Rock Iſing-Glaſs*, reſembling alabaſter, but not ſo hard; when the ſun ſhines upon it, it reflects the beams ſo ſtrongly, that they dazzle the eyes of the ſpectators; there was no art or accuracy in the workmanſhip, and but very little carved work, and that mean enough, and the cement was little better than dirt; round about were the ſmall apartments or chambers of the monks, built arch-wiſe, only one ſtory above ground; but underneath were ſeveral cells or vaults, larger than the chambers, which perhaps might ſerve for their ſchools, or working houſes; in the middle of the area ſtand the ruins of ſeveral buildings, ſome of which ſeem to have been ciſterns for water, and it may be the bathing places; but one heap was moſt remarkable, which probably was the abbot's or biſhop's houſe; and another, which was the ruins of their church; this was formerly no inelegant ſtructure, being built in the form of our churches, and diſtinguiſhed into three iſles, of which the middle one is ſupportd by 18 turned marble pillars, with capitals upon them, not of marble, but of a ſort of clay, and caſt into that ſhape, but of a colour exactly reſembling the pillar it ſelf; and what confirms their being caſt, is a *Greek* inſcription to be ſeen on all of them; the letters of which are not made by inciſion in the ſtone, but ſeem to be ſtamped, ſtanding out higher than the diſtance between them; and on one of them, by miſtake, they are ſo placed, as to be read after the oriental manner, from the right hand to the left; the words are theſe, with the crucifex before them.

+ ΕΠΙ ϹΕΡΓΙϐ ΕΠΙϹΚ° Τϐ ϹΥΝΓΕ͂Ν ΜΑΡϖΝΙϐ Τϐ ΧϖΡΕΠΙϹΚ°.

From hence their guide led them to the river, by the aſſiſtance of two ſmall hills, called *Aff-Dien*, their way lying north, and a little bending to the eaſt. They pitched on the reach of the river, where it was not very broad, not being above half a muſket ſhot over.

October 12, About ſun-riſing they proceeded on their journey keeping along the banks of the river, which for the moſt part led them weſt and northweſt; and here their travelling proved very agreeable, having the river on the right hand, and hills of marble, or other fine ſtone, on the left; and delightful groves of

of tamariſk, mulberry, and other trees to paſs thro'; here every thing looked freſh and verdant; they had alſo a fine proſpect of the oppoſite ſhore, and they could ſee a great way into *Meſopotamia*.

October 13, they had the ſame proſpect as they had the preceeding day, travelling as near the river as the road would permit; and having made a ſtage of about 6 hours, they reſted under the ſhade of the tamariſk-trees by the river ſide. In their way they ſaw the ruins of a city, called *Baulus*, where the *Turks* had formerly a *Sangiac*; but now there is neither inhabitant in the place, nor houſe ſtanding, but the ruins of houſes, and an octagonal tower of a conſiderable height; *viz.* 107 ſteps, and beautified on the outſide with flouriſhes, and an *Arabic* inſcription round about; it is a handſome ſtructure, and probably the work of the *Mamalukes*, ſince whoſe time little has been done to adorn, but a great deal to deſtroy and waſte this country. After dinner they ſet out ſooner than ordinary, hoping to reach the tents of *Aſſyne*, before it was late, but it was ſun-ſet before they got to *Fay*, a fountain by which he lay; they had travelled ſtill on the ſame point; *viz.* N. W. with the proſpect of the river for the greater part of the way. King *Aſſyne*'s tents covered a large plain, and took up ſo vaſt a ſpace, that from a riſing ground the utmoſt extent of them could not be ſeen; the king's tent was nearly in the middle, the reſt pitched about it, not in a circular manner, but extending in length as the plain opened; or, for the better conveniency of a currrent of water, which from the fountain ran thro' the middle of the tents; it was not at all diſtinguiſhable from the reſt, but by its bigneſs, being all made of hair-cloth. It cannot well be doubted, that they are deſcended from the old *Arabes Scenitæ*, living juſt in the ſame manner, and having no ſettled abode, but removing from fountain to fountain, as they find graſs and water for their ſheep and camels; they affect to derive themſelves from *Iſhmael*, the ſon of *Abraham*. As ſoon as the merchants alighted they were attended by the officers of the *Emir*, and conducted to a very noble tent, built after the *Turkiſh* mode, and pitched next to his own; before ſupper the king himſelf made them a viſit in perſon, bidding them welcome to *Fay*, and aſking what they had ſeen in their travels; how they liked *Tadmor*, and whether they had found a treaſure there? For theſe people entertain a notion, that the *Franks* go to ſee old ruins, becauſe they there meet with inſcriptions, which direct them to ſome hidden treaſure; and therefore it is no unuſual thing with them, when they find

find a ſtone with an inſcription on one ſide, to turn that down to the ground, that it may not be ſeen or read by any. When ſupper was brought in, there was a large diſh of *Pilau* in the middle and 12 or 13 diſhes of ſeveral ſorts of meat about it, all dreſſed after their manner, but exceeding good. After the merchants had eat and drank what they pleaſed, they were ſucceeded by their ſervants, it being the cuſtom of the *Arabs* and *Turks* too, from the higheſt to the loweſt, to eat at the ſame table, the beſt ſort ſitting down firſt, and ſo in order, till all have done. Next morning the king went to a great entertainment made him by one of his grandees; two young camels were killed to furniſh out this ſumptuous feaſt, which is the higheſt piece of magnificence and greatneſs, to which theſe people, whoſe greateſt riches conſiſt in camels, can arrive; the tent was very large, and to make it ſtill more capacious, it was left open towards the weſt; the king was ſeated at the north end, about the middle of the tent, upon a place raiſed with cuſhions and quilts and before him carpets; neither did he ſit croſs-legged, as the reſt of the company was obliged to do, but in a leaning poſture; they ſeemed to obſerve an exact order in their places; and when any perſon of note entred, ſuch, as were near his place, roſe up, and ſtood till he had ſeated himſelf; but far the greateſt part could not come within the compaſs of the ring; the left hand is here eſteemed the more honourable place; dinner was ſerved up in large wooden bowls carried by two men, of which there were about 50 or 60 in number, with ſeveral ſmall ones; in the centre there ſtood a bowl of a larger ſize, in which were the camel's bones, and a thin broth in which they were boiled; the other great ones ſeemed to be filled with one and the ſame ſort of food, which was a kind of plum-broth made of rice, and the fleſhy part of the camel, with currants and ſpices; the ſmaller diſhes were, for the moſt part, charged with rice, dreſſed after ſeveral modes, ſome of them having *Leben*, a thick ſour milk, poured upon them, which is in great eſteem in theſe hot countries, being very uſeful in quenching thirſt. Knives, forks, ſpoons, trenchers, *&c.* are ſilly impertinent things in the eſteem of the *Arabs*, inſtead of uſing theſe, they thruſt their hands into the diſh and eat by handfuls; when the table was thus plentifully furniſhed, the king riſing from his ſeat, went and ſat down to that diſh that was directly before him, as did alſo the reſt; becauſe the diſhes in the middle were too remote to be reached at, there was an officer on purpoſe, who, ſtepping in amongſt them, and ſtanding in places deſigned for that end, with a long ladle in both his hands,

helped

helped any one according to his desire. After the king had eat what he thought fit, he rose up and washed, and retired back to his former seat.

October 15, in the morning the merchants proceeded on their journey homewards, and in about 3 ½ hours arrived at *Seray*, and from thence they came to *Sherby Fountain*, and from this place they had not above 7 or 8 hours to *Aleppo*.

The ancient State of the City of Palmyra; *by Mr.* Edm. Halley. Phil. Tranf. N° 218. p. 160.

THE city of *Tadmor*, whose remains in ruins do so evidently demonstrate the once happy condition thereof, seems very plainly to be the same city, which *Solomon* the great king of *Israel* is said to have founded under that name in the desart, both in 1 *Kings* IX. 18 and 2 *Chron.* VIII. 4; in the translation of which, the vulgar *Latin* version, said to be that of St. *Jerome*, has it, *Condidit Palmyram in Deserto*; and *Josephus* tells us, that he built a city in the desart, and called it *Thadamora*, and the *Syrians*, at this day, says he, call it by the same name, but the *Greeks* call it *Palmyra*; the name is therefore *Greek*, and consequently has no relation to the *Latin Palma*, and seems rather derived from Παλμυς, or Παλμυς, which *Hesychius* interprets Βασιλευς πατηρ, or perhaps from Παλμυτης, which, according to the same author, was an *Egyptian* god; nor is the word תדמר but תמר which in *Hebrew* signifies a palm-tree.

History is silent as to the fate and circumstances of this city, during the great revolutions in the several empires of the east; but it may well be supposed, that so advanced a garrison as this was, being above 300 miles from *Jerusalem*, continued not long in the possession of the *Jews*, who immediately after *Solomon* fell into civil dissention, and divided their force; so that it is not to be doubted, but that it submitted to the *Babylonian* and *Persian* monarchies, and afterwards to the *Macedonians* under *Alexander* and the *Seleucidæ*. But when the *Romans* got footing in those parts, and the *Parthians* seemed to put a stop to their farther conquests in the east, then was this city of *Palmyra*, by reason of its situation, being a frontier town, and in the middle of a vast sandy desart, where armies could not well subsist to reduce it by force, courted and caressed by the contending princes; and permitted to continue a free state, a mart, or staple for trade, for the conveniency of both empires, as plainly appears from *Appian* and *Pliny*.

Appian

Appian de Bell. Civil. l. V. tells us, that M. *Antony*, after his victory at *Philippi*, about 40 years before Chriſt, ſent his horſe to plunder the city of *Palmyra*, pretending only that they were not ſufficiently in the *Roman* intereſt; ὅτι Ῥωμαίων μὲν Παρθυαίων ὄντες ἐφοροι ἐς ἑκατέρους ἐπιδέξιως εἶχον, and that being merchants, they conveyed the *Indian* and *Arabian* commodities by the way of *Perſia* into the *Roman* territories, tho' the true reaſon was their riches; but the *Palmyrenes*, being informed of their deſign, took care to prevent them, and ſo eſcaped plunder; and this attempt of *Antony*'s occaſioned a rupture between the two empires. The words of *Pliny*, above 100 years after, do likewiſe teſtify that this city then continued in the ſame enjoyment of its liberties. *Palmyra Urbs nobilis ſitu, divitiis ſoli, atque aquis amænis, vaſto undique ambitu arenis includit agros, ac velut terris exempta a rerum naturâ, privatâ ſorte inter duo imperia ſumma Romanorum Parthorumque, & prima in diſcordiâ ſemper utrinque cura*; whereby it appears, that it was a common wealth in the time of *Veſpaſian*, and its ſituation is truly deſcribed, as it were an iſland of fertile land, ſurrounded with a ſea of barren ſands; ſuch ſpots, according to *Strabo*, were frequent in *Libya*, and by the *Egyptians* called *Abaſes*, whence poſſibly the name of the *Abaſſine* nation is derived.

With theſe advantages of freedom, neutrality, and trade, for near two centuries, it is not to be wondered at that it acquired that ſtate and wealth anſwerable to the magnificence of theſe noble ſtructures; but when the *Romans* under *Trajan* had taken *Babylon* and *Cteſiphon*, the then ſeat of the *Parthian* empire, the *Palmyrenes* were at length determined to declare for them; which they did by ſubmitting themſelves to the emperor *Adrian*, about the year of Chriſt 130, when he made his progreſs thro' *Syria* into *Egypt*; and that magnificent emperor, being highly delighted with the nature, ſtrength, and ſituation of the place, was pleaſed to adorn and build it; when probably he beſtowed on it the privileges of a colony *Juris Italici*, which it enjoyed, as *Ulpian* aſſures us, and the inhabitants, in gratitude to the emperor, would have themſelves called *Hadrianopolitæ*, ἐπικτισθείσης τῆς πόλεως ὑπὸ τοῦ Αὐτοκράτορος, ſays *Stephanus*; nor is it unlikely, that many of thoſe marble pillars were the gift of that emperor, and particularly thoſe of the long *Porticus*; becauſe none of the inſcriptions are prior to that date, and that it was uſual with the *Cæſars* to preſent cities, that had obliged them, with marble pillars to

adorn their publick buildings; theſe in this place were not far to fetch, the neighbouring mountains affording marble quarries: But the magnitude of the porphyry columns is indeed very remarkable, conſidering how far theſe vaſt ſtones muſt have been brought by land-carriage to this place, it not being known that any other quarries yield it, except thoſe of *Egypt*, which lie about mid-way, between *Cairo* and *Siena*, between the *Nile* and the *Red Sea*; the ſtone is very valuable for its colour and hardneſs, and becauſe it riſes in blocks of any magnitude required; therefore is a great miſtake to ſuppoſe it factitious.

From the time of *Adrian* to that of *Amelian*, for about 140 years, this city continued to flouriſh and encreaſe in wealth and power to that degree, that when the emperor *Valerian* was taken priſoner by *Sapores*, king of *Perſia*, *Odænathus*, one of the Lords of this town, was able, whilſt *Gallienus* neglected his duty both to his father and his country, to bring a powerful army into the field, and to recover *Meſopotamia* from the *Perſians*, and to penetrate as far as their capital city *Cteſiphon*; by this means, doing ſo conſiderable a ſervice to the *Roman* ſtate, that *Gallienus* thought himſelf obliged to give him a ſhare in the empire; but, by a ſtrange reverſe of fortune, this honour and reſpect to *Odænathus* occaſioned the ſudden ruin and ſubverſion of the city; for he, and his ſon *Herodes*, being murdered by *Mæonius* their kinſman, and dying with the title of *Auguſtus*, his wife *Zenobia*, in right of her ſon *Waballathus*, then a minor, pretended to take upon her the government of the eaſt, which ſhe adminiſtred to admiration; and ſoon after, *Gallienus* being murdered, ſhe ſeized the government of *Egypt*, and held it during the ſhort reign of the emperor *Claudius Gothicus*; but *Aurelian*, coming to the imperial dignity, would not ſuffer the title of *Auguſtus* in this family, tho' he allowed them that of *Vice Cæſaris*, as plainly appears by the *Latin* coins of *Aurelian*, on the reverſe of which is *Waballathus* with theſe letters U. C. R. I M. OR. which *P. Hardouin* has very judiciouſly interpreted, *Vice Cæſaris Rector Imperii Orientis*, but without the title of *Cæſar* or *Auguſtus*, and with a laurel inſtead of a diadem. But both *Waballathus* and *Zenobia* are ſtiled CEBACTOI in the *Greek* coins, probably made within their own juriſdiction.

But *Zenobia* not ſatisfied with any thing leſs than a ſhare in the empire, and *Aurelian*, perſiſting not to have it diſmembred, marched againſt her, and having in two battles routed her forces,

forces, he ſhut her up, and beſieged her in *Palmyra*; and the beſieged, finding that the reſiſtance they made availed not againſt that reſolute emperor, ſurrendred the town; and *Zenobia*, flying with her ſon, was purſued and taken; with which *Aurelian* being ſatisfied, ſpared the city, and leaving a ſmall garriſon, he marched to *Rome* with this captive lady; but the inhabitants, believing that he would not return, ſet up again for themſelves, and, according to *Vopiſcus*, they ſlew the garriſon; which *Aurelian* underſtanding, tho' by this time he had got into *Europe*, yet he ſpeedily returned with his uſual fierceneſs, and collecting a ſufficient army by the way, he again took the city without any great oppoſition, and put them to the ſword with an uncommon cruelty, and delivered them to the pillage of his ſoldiers. And it is obſervable, that none of the *Greek* inſcriptions are poſterior to the date of this calamity, which befel the city in, or about the year of Chriſt 272, after it had been 9 or 10 years, not without glory, the ſeat of the empire of the eaſt.

In this appears the great uſefulneſs of coins to illuſtrate hiſtorical facts; for by them alone it is made out, that there was ſuch a prince as *Waballathus*, called *Balbatus* by *Vopiſcus*; and from the ſame coins it appears, that *Odænathus* had the title of *Auguſtus* for four years, and *Waballathus* for at leaſt ſix; and that the firſt year of *Aurelian* was the fourth of *Waballathus*; and by the teſtimony of *Pollio*, *Odænathus* was declared emperor of the eaſt, *Gallieno & Saturnino Coſs.* which was *Anno Chriſti* 263, and died before *Gallienus*, *Anno* 267, which, by the coins, was the firſt of *Waballathus*; he therefore immediately ſucceeded *Odænathus*, and was doubtleſs his eldeſt ſon by *Zenobia*, and not his grandſon, the ſon of *Herodes*, as ſome learned men have ſuppoſed; for if *Zenobia* could not bear that *Herodes*, ſon of *Odænathus* by a former wife, ſhould ſucceed his father, in prejudice of her children, and for that reaſon was conſenting to his murder, as *Pollio* intimates in *Herodes* and *Mæonius*, much leſs would ſhe ſuffer the title of *Auguſtus* in the ſon of *Herodes*, and eſpecially, when her own ſons were elder than ſuch grandſon; ſo that it is moſt probable, that *Herennianus* and *Timolaus*, whom *Pollio* reckons amongſt the thirty tyrants, might be the younger ſons of *Zenobia*, on whom alſo, out of motherly affection, ſhe might beſtow the ſame titles of honour.

But it muſt be obſerved, that in the *Greek* coins this prince's name is uſually written ΑΥΤ. ΕΡΜΙΑϹ ΟΥΑΒΑΛΛΑΘΟϹ

ΑΘΗΝΟΥ, as *Triſtan* ſays he found on ſeveral medals, but *Patin* has the laſt word only ΑΘΗ; Mr. *Halley* is of opinion, that his true name was *Æranes Waballathus*, tho' perhaps the remoter cities of *Aſia* and *Ionia* might, by miſtake, write it *Hermias*; and it is probable, that ΑΘΗΝ might ſtand for the firſt letters of ΟΔΗΝΑΘΟϹ, which in *Syriac* began with an *Aleph*, and the Δ they uſed inſtead of Θ, as the month *Xanthicus* is in many of the inſcriptions written ΞΑΝΔΙΚΟ, which doubtleſs was pronounced like D *Blæſum*, or the *Saxon* Ð.

Tho' this city was then ſo roughly handled by *Aurelian*, yet it is certain, that he did not burn it, or deſtroy the buildings thereof; and tho' *Zoſimus*, on this occaſion, uſes the words τὴν πόλιν κατασκαψας, yet that ſeems only to relate to his demoliſhing the walls and fortifications of the place; and that emperor's own letter, extant in *Vopiſcus*, ſufficiently ſhews that he ſpared the city itſelf, and that he took care to re-inſtate the beautiful temple of the ſun, which had been plundered by his ſoldiers. However, the damage then ſuſtained was never retrieved by the inhabitants, and this city made no figure in hiſtory ever after. About the year of Chriſt 400, it was the head quarters of the *Legio prima Illyricorum*, and tho' *Stephanus* gives it no better title than that of Φρούριον, yet it appears to have been an archbiſhop's ſee, under the metropolitan of *Damaſcus*. To ſay in what age, or from what hand it received its final overthrow, which reduced it to the miſerable condition it now appears in, we have no light from hiſtory; but it is probable, it periſhed long ſince in the obſcure ages of the world, during the wars of the *Saracens*, and being burnt and deſolated, it was never re-built, which is the reaſon the ruins lie ſo entire, in a manner as they were left. As to the geographical ſite of *Palmyra*, *Ptolemy* places it in the latitude of *Tripoly* on the coaſt of *Syria*, and four degrees more eaſterly, *viz.* Παλμυρα. ες ϛ. λδ. and he makes it the capital of 16 cities in *Syria Palmyrena*, whereof *Alalis*, *Danaba*, and *Evaria* were afterwards biſhop's ſees; *Pliny* places it CCIII miles from the neareſt coaſt of *Syria*, and CCCXXXVII from *Seleucia* on the *Tigris* near *Bagdat*; *Joſephus* places it one day's journey from *Euphrates*, and ſix from *Babylon*, which muſt be underſtood of a horſeman's journey, of about 60 miles a-day, it being more than ſo much from the *Euphrates*: *Ptolemy* mentions alſo a river running by *Palmyra*, which did not appear to our travellers, unleſs that gut or channel, wherein they were overflowed by the rain-waters, were the bed thereof; which may poſſibly run in a conſtant

conſtant ſtream in the winter, or in times of much rain; but this, as the rivers of *Damaſcus* and *Aleppo* at this day, is made by *Ptolemy* to have no iſſue but to go off in vapours, and to be imbibed by the thirſty earth of theſe deſarts.

The *Æra*, or account of years, obſerved by the *Palmyrenes* in their inſcriptions, is evidently that of *Seleucus*, called afterwards *Dhilcarnain* or *Bicornis* by the *Arabs*, and uſed by them till above 900 years after Chriſt, and not that of the death of *Alexander*; this may be demonſtrated from an inſcription, wherein *Alexander Severus* is ſtiled ΘΕΟϚ, that is, after the death and conſecration of that emperor, or after the year of our Lord 234; and from the name of *Julius*, who, when this inſcription was ſet up, was *Præfectus Prætorii*, and could be no other than *Julius Philippus Arabs*, who might be eſteemed by the *Palmyrenes* as their countryman, it follows, that it was in the laſt year of *Gordian*, *An. Chriſt.* 242 or 243; and that emperor being ſoon after murdered by the treachery of this *Philip*, who ſucceeded him, and his treaſon coming afterwards to light, it is not to be wondered at that his name was purpoſely effaced in this inſcription; the date thereof *An.* 554, ſhews the beginning of this account 311, or 312 years before Chriſt co-incident with the *Æra* of *Seleucus*, which was alſo uſed by ſeveral other cities in the eaſt.

The Cure of a Horſe *Staked into his Stomach*; *by Dr.* Wallis. Phil. Tranſ. N° 219. p. 178.

A Horſe, leaping over a hedge, chanced to ſtake himſelf very dangerouſly; the farrier, upon ſearching the wound, and enlarging it in the outward ſkin and rim of the belly, found a wound in the ventricle or maw, at leaſt three inches in length; he then removed the maw outwardly and ordered a ſervant to cleanſe it from the chewed graſs, being leſs likely to mortify when empty; the maw being thus cleanſed, the farrier ſewed up the wound therein, and then thruſt it back into the body; and afterwards ſewed up the wound in the rim of the belly; the wound in the outward ſkin he did not ſew up, but only tacked it looſely together about the middle, leaving room on both ſides to put in tents and medicines for the healing of it; the horſe after this continued for ſome time much indiſpoſed, but in a month or ſix weeks time, with careful attendance, the wounds were cloſed, and perfectly cured; and the horſe worked at the plough and did other ſervices as before.

The

The Soap-earth *from* Smyrna; *by Dr.* Edw. Smith. Phil. Tranſ. N° 220. p. 228.

Soap-earth is found only in two places near *Duraclea*, a large open village about ſix leagues to the eaſtward of *Smyrna*, and in a very flat plain, about a league weſtward of the river *Hermus*, and ſeveral leagues from the ſea; it is a fine *Soap*, and at the firſt gathering, it is a whitiſh earth, which boils or ſhoots up out of the earth; it is gathered always before ſun-riſing, and in the morning, when there falls no dew, ſo that a ſtock muſt be laid up for the whole year in the ſummer months; it comes up in ſome places an inch or two above the ſurface of the ground; but the ſun riſing upon it, makes it ſink down again; every morning there is a new crop, tho' all be taken away which the preceeding day afforded; the ſoil, that produces it, lies low in both places, and is in the winter waſhy; it is covered, tho' but thinly, with graſs. Three hundred drams of this earth put into a retort *in Balneo Arenæ* for 12 hours in a violent fire, gave between 5 and 6 ounces of an inſipid phlegm. Finding therefore no volatile ſalt, as what muſt have come over by the foregoing experiment; 200 drachms calcined at a bagnio-fire, in a *German* crucible, were diſſolved in water; the compoſition of earth and water, boiled into a lixivium, made 500 drachms; it was boiled for three hours, ſtill ſcumming off the froth, then it was filtrated, after that evaporated over a gentle fire; it was kept to chryſtallize, and it appeared like a fixt ſalt. At the ſoap-houſes they mix $\frac{3}{4}$ of earth with $\frac{1}{4}$ of lime, and diſſolve the compoſition in boiling water; where ſtirring it often with a ſtick, there floats a-top a thick browniſh ſubſtance, which they preſerve in baſons a-part, and this ſcum is much richer than the liquor underneath; yet both are uſed in making the ſoap. Into a large copper caldron they put 50 kintals of oil, applying a very hot fire, which burns continually until the ſoap is made. When the oil has boiled, they begin to throw in ſome of the ſcum, and ſometimes of the liquor, from which the ſcum was taken. They often repeat this throwing in of the ſcum and liquor for 13 or 14 days, in which time the ſoap is uſually perfected; the browniſh ſcum, and what is uſeful of the liquor, incorporating with the oil, what is uſeleſs ſinks to the bottom of the caldron, where it is let out to make room for throwing in more. The water, thus let out, is again thrown upon a new compoſition of earth and lime; but when the liquor becomes wholly inſipid, it is then judged to be exhauſted. After 13 or 14 Days, when the ſoap is finiſhed, it is laded out of the

the boiler, and laid upon a lime floor to dry. They proportion two load of earth of five kintals each, to 50 kintals of oil; the produce is between 70 and 80 kintals of ſoap. The earth is bought at a dollar a load, and the ſoap, at 6 ¾ a kintal. There is employed in making ſoap yearly at *Smyrna* 1000 kintals of oil. The carrying of ſoap-earth employs 1000, or 1500 camels daily, for eight months; the other four ſummer months being too hot for camels to travel in. An ordinary ſoap-houſe produces 1000 dollars a year clear profit, one year with another.

Chylification; *by Mr.* Will. Cooper. Phil. Tranſ. N° 220. p. 231.

THE *Dentes inciſorii* are employed to divide the food; when a proportionable piece is thus taken into the mouth, the lower jaw is variouſly moved by its proper muſcles and maſtication is begun and carried on by the aſſiſtance of the tongue, cheeks and lips; the two firſt ſtill applying the leſs divided parts of the aliment to the *Dentes molares*, till there is an equal comminution of all its parts. At the ſame time ſeveral of the muſcles, employed in the motion of the lower jaw, are alſo ſerviceable, in promoting the ſpittle ſeparated from the blood by the *Parotid Glands*, the glands of the lower jaw, and thoſe under the tongue into the mouth; the ſalival glands of the cheeks and lips, alſo contributing their juices, do all together join with the maſticated aliment, before or at the ſame time it is made fit to be ſwallowed; which action is called *Deglutition*, and is thus performed: The aliment, as well what is fluid, as what is maſticated, being lodged on the tongue, which does form itſelf a little into a hollow, by means of its own proper muſcular fibres, for the more commodious holding the greater quantity, its tip and ſides are applied to the inſides of all the teeth of the upper jaw, the tongue is ſuddenly drawn up by the *Muſculi Styloglo ſſi* and *Myloglo ſſus*, together with thoſe muſcles which pull the *Os Hyoides* upwards; at the ſame time the *Fauces* are alſo drawn up, and their cavity enlarged by the *Muſculi Stylopharyngei*; and about two thirds of the ſuperior ſurface of the tongue is adequately applied to the roof of the mouth; the *Epiglottis*, from its poſition being conſequently depreſſed, does thereby cover the *Glottis* or *Rimula* of the *Larynx*, and prevents any part of the aliment from deſcending into the wind-pipe. In this part of the action of deglutition, the glands under the tongue, and the excretory ducts of thoſe of the lower jaw, are compreſſed, and their ſeparated liquors or ſpittle is diſcharged by their *Papillæ*, ſituated at the lower part of the

Frænum

Frænum, or ligament of the tongue, and this is done by the *Muſculus Mylo-hyoideus*. When the aliment is thus forced into the *Fauces*, or upper part of the gullet, at the ſame time the *Gargareon*, together with the *Uvula*, are drawn upwards and backwards by the *Muſculi Sphænoſtaphylini*; by which means any part of the aliment is hindred from aſcending into the *Foramina Narium*; and the *Fauces* by the *Muſculus Pterygopharyngeus* and *Oeſophageus*, are contracted; whereby the aliment is not only compreſſed into the gullet, but the matter ſeparated from the blood by the glands of the *Fauces*, eſpecially of thoſe large ones called *Tonſillæ*, is forced out of their cells or excretory ducts to join with it in its deſcent into the ſtomach, by the gullet, thro' which latter it paſſes, by the action of its muſcular fibres.

The aliment, thus impregnated with *Saliva* in maſtication and deglutition, being received into the ſtomach, it there meets with a juice ſeparated from the blood by the glands of that part, whoſe excretory ducts open into the cavity of the ſtomach; by the commixture of theſe liquors, whether of the *Saliva* or juice of the ſtomach, a proper *Menſtruum* is compoſed, by which the parts of the aliment are ſtill more and more divided by its inſinuating into their pores, by which the air, before impriſoned in their leſs divided parts, is not only more diſentangled, but by the natural heat, it muſt neceſſarily ſuffer ſuch a rarefaction, as that thereby the whole ſtomach becomes ſtill more and more diſtended. Hence it is that we have leſs appetite ſome time after eating than we had immediately upon it; hence alſo ariſe thoſe frequent eructations from divers aliments, as old peaſe, cabbage, and divers other vegetables we frequently eat, all which prove very prejudicial to depraved appetites and weak ſtomachs; at the ſame time, when this intumeſcence and agitation of the matter is made in the ſtomach; the contents of the neighbouring excretory ducts, *viz*, the bile in the gall bladder, and ducts of the liver, and the pancreatic juice in the *Ductus pancreaticus* are compreſſed into the *Duodenum*, thro' the diſtenſion of the ſtomach itſelf; the refluent blood of the ſtomach, at that inſtant, being, in ſome meaſure, retarded, whereby the muſcular fibres are more liable to be contracted. Nor can we conceive how the liquor of the ſtomach, after uniting with the ſpittle and aliment, ſhould be ſtill ſo plentifully excreted from the glands of that part, as to irritate its internal membrane, and excite its muſcular fibres to contract, ſince the muſcles of the *Abdomen* would, in like manner as in vomiting, be drawn into a conſent of cooperating, and the aliment would be forcibly rejected by the mouth; beſides, ſhould the liquor of the ſtomach

prove

prove so prejudicial in chylification, what would the case be, immediately on the discharge of all its contents? The irritation, the stomach undergoes in hunger, seems only to arise from an accumulation of the spittle in the stomach, in conjunction with the liquor of the glands of that part; hence it is we rather discharge the spittle at that time by the mouth, than suffer it to descend into the stomach; hence also proceeds, what is called the watering of the mouth; hence likewise, when the *Saliva* is vitiated, the appetite is depraved. The stomach, by means of its muscular fibres, contracting it self, does gradually discharge its contents by the *Pylorus* into the *Duodenum*, in which gut, after a small semi-circular descent, it meets with the pancreatic juice and bile, both which joining with it, renders some parts of the aliment more fluid, by still disuniting the grosser parts from the more pure; and here chylification is made perfect.

The bile, which abounds in lixivial salts, and is apt to mix with the grosser parts of the concacted aliment, stimulates the guts, and deterges, and cleanses their cavities of the mucous matter, separated from the blood by the glands of the guts, and lodged in their cavities, which not only moistens the insides of the guts, but defends the mouths of the lacteals from being injured by foreign bodies, which often pass that way. The contents of the intestines do still move on by means of the peristaltic or worm-like motion of the guts, whilst those thinner parts fitted for the pores of the lacteals, called chyle, is absorbed by them; the thicker parts move still more slowly on, and being often retarded in their progress by the *Valvulæ conniventes*, all the chyle or thinner parts are at length entirely absorbed, and what remains is merely excrementitious, and fit only to be excluded by stool.

The analagous white appearance of the chyle, whether in the stomach, or intestines, and always in the lacteals, and thoracic duct, may be seen in the commixtures of divers liquors, which apart, exhibit no such appearance; nor is this phænomenon any other than a transposition of particles; whether by a *Menstruum*'s insinuating into them, and dividing them into gross globules, as an acid into a sulphur, or vinegar into oil, *&c.* or else by precipitation, as when a gummous or resinous body is dissolved in a spirituous *Menstruum*, and mixed with a phlegm; so tincture of myrrh and benjamin, *&c.* make a milky appearance in common water.

The longitudinal and transverse orders of fibres of the guts, are the instruments by which their peristaltic motion is performed,

which motion is not only neceſſary for propelling their contents; but by the reciprocal contraction of thoſe muſcular fibres of the guts, and oppoſition of the *Valvulæ conniventes*, the mouths of the lacteals are diſpoſed to receive what is prepared for them; hence it is, that we can by no means make any fluid whatever paſs from the cavity of the guts into thoſe lacteals in a dead animal. A farther uſe of this contraction of the muſcular fibres of the inteſtines, is to accelerate the chyle in its progreſs in the lacteals, 'till the *Lympha* derived from the extremities of the arteries of the guts mixes therewith; which conjunction is made in the lacteals, before they leave the external ſurface of the inteſtines. By this means, the progreſſion of the chyle is made towards the meſenteric glands, into whoſe cells it is received, and where it again mixes with a juice conveyed by the arteries of each gland; which juice or lymphatic liquor, not only farther dilutes the chyle, like that from the arteries of the inteſtines, but adds a freſh *Impetus* thereto; by which its motion is farther promoted thro' the *Lactea ſecundi Generis*, ariſing out of each *meſenteric* gland, and diſcharging their contents into the *Receptaculum Chyli*. Here the chyle mixes with the *Lympha*, which comes from the lymphæducts of the inferior limbs and neighbouring parts, whereby the chyle is not only farther elaborated, but its aſcent into the thoracic duct is promoted, whoſe ſeveral diviſions and inoſculations, like the veins of the teſticles, its number of valves, looking from below upwards, and its advantageous ſituation between the great artery and *Vertebræ* of the back, together with the lymphæducts, diſcharging their *Lympha* derived from the lungs and neighbouring parts of the *Thorax*, do demonſtrate the utmoſt art, in order to promote its aſcent towards the left ſubclavian vein. Before the thoracic duct, thus charged with the chyle and *Lympha*, empties itſelf into the ſubclavian vein, it receives the *Lympha* brought from the ſuperior parts; all which, mixing together, are ſoon diſcharged into the left ſubclavian vein, where meeting with the refluent blood of the ſuperior parts, paſſes with it thro' the deſcending trunk of the *Vena cava*, and joins with the refluent blood of the inferior parts, in the right auricle of the heart; whence it is expelled by its contraction into the right ventricle, when the heart is in *Diaſtole*; but by the *Syſtole*, or contraction of the heart, it is thence propelled into the *Arteria pulmonalis*, thro' whoſe extremities, in conjunction with thoſe of the *Vena pulmonalis*, it paſſes to the left auricle and ventricle of the heart, from whence it is again diſcharged in the *Syſtole* into the *Aorta*, by whoſe branches it is con-

conveyed all over the body; the three *tricuſpid Valves* in the right, and the two *mitral Valves* in the left ventricle of the heart, oppoſing its return into the veins, and the ſemilunar valves of the *Arteria pulmonalis* and *Aorta*, preventing its ingreſs into the ventricles, are ſufficient to demonſtrate the neceſſity of a circulation of the blood.

Microſcopical Obſervations; by Mr. J. Harris. Phil. Tranſ. N° 220. p. 254.

MR. *Harris* examined a ſmall drop of rain-water, that had ſtood in a galley-pot in a window for about two months; he took it with the head of a ſmall pin from the diſcoloured ſurface of the water, and in it he obſerved 4 ſorts of animals; in the clear part of the drop were two kinds, and both very ſmall; ſome were of the figure of ants-eggs, theſe were in a continual ſwift motion; and he found that this kind of oval figure is the moſt common to the *Animalcula* found in liquors; the other ſpecies, that were in the clear part of the drop, were more oblong, about three times as long as broad; theſe were exceeding numerous, but their motion was ſlow in compariſon of the former. In the thick part of the drop, for the water had contracted a thickiſh ſcum, he alſo found two ſpecies of animals, as a kind of eels, like thoſe in vinegar, but much ſmaller, and with their extremities ſharper; theſe would wriggle out in the clear part, and then ſuddenly betake themſelves back again, and hide themſelves in the thick and muddy part of the drop, much like common eels in the water; he ſaw here alſo an animal like a large maggot, which would contract itſelf into a ſpherical figure, and then extend itſelf again; the end of its tail appeared with a forceps, like that of an ear-wig; and he could plainly ſee it open and ſhut its mouth, from whence air-bubbles would frequently be diſcharged; of theſe he could number about 4 or 5, and they ſeemed to be buſy with their mouths, as if feeding. Theſe four kinds of living creatures he afterwards found in many other drops of the ſame corrupted water, in the film and ſcum, which was on the ſurface; for under that, in the lower parts of the water, he could never find any animals at all, unleſs when the water was diſturbed, and the ſurface ſhook down into, and mingled with the lower parts.

With a much better microſcope he examined ſome rain-water, that ſtood uncovered a pretty while, but had not contracted any ſuch thick and diſcoloured ſcum, as that abovementioned had; in this, when it was clear, he could not find any animals at all; but

a little thin white ſcum, that like greaſe began to appear on the ſurface, he found to be a number of exceeding ſmall *Animalcula* of different ſhapes and ſizes, much like thoſe produced by ſteeping barley in water.

At the ſame time he looked on a ſmall drop of the green ſurface of ſome puddle-water; this he found to be altogether compoſed of animals of ſeveral ſhapes and magnitudes, but the moſt remarkable were thoſe, which he found gave the water that green colour, and were oval creatures, whoſe middle part were of a graſs-green, but each end was clear and tranſparent; they would contract and dilate themſelves, tumble over and over ſeveral times, and then ſhoot away like fiſh; their head was at their broadeſt end, for they ſtill moved that way; they were very numerous, but yet ſo large, that he could diſtinguiſh them very plainly with a glaſs that did not magnify very much; amongſt theſe were interſperſed many other ſmaller and tranſparent animals, like thoſe mentioned juſt now, as found in the whitiſh ſcum, that was in ſome rain water, which had ſtood a while uncovered. He found another ſort of creatures in the water, ſome of which he had kept in a window, in an open glaſs; they were as large as three of the other with the green border about their middles, but thoſe were perfectly clear and colourleſs. Then alſo examining more accurately the belts or girdles of green, that were about the abovementioned animals, he found them to be compoſed of globules, ſo like the rows or ſpawn of fiſh, that he could not but imagine, they ſerved for the ſame uſe in theſe little animals; for in two days, the number of the old ones, with the green girdles, decreaſed more and more, and at laſt he could not ſee one of them ſo encompaſſed, but they were all clear and colourleſs from end to end. In a very ſmall drop of puddle-water, which was blueiſh, or rather of a changeable colour between blue and red, he found prodigious numbers of animals, and of various magnitudes; but he found amongſt them none with thoſe girdles abovementioned, either of green or any other colour. He then alſo examined the ſurface of ſome other puddle-water, that looked a little greeniſh; and this he found ſtocked with infinite numbers of animals; amongſt theſe, there were many of a greeniſh colour, but they all moved about with ſuch ſwiftneſs, and were ſo near each other, that he could not diſtinguiſh, whether the green colour were all over their bodies, or whether it were only round their middle in girdles, as before; but from the roundneſs of their figure, and their ſmallneſs he judged that they chiefly conſiſted of the young animated ſpawn of the abovementioned

tioned animals; he found that the point of a pin, dipped in ſpittle, would preſently kill them all. In ſome mineral chalybeate water, which had ſtood in a phial unſtopt for about three weeks, he obſerved two ſpecies of animals; one exceeding ſmall, and the other very large; which latter ſort had on the tail ſomething like fins; there were but very few of the other ſort. The compounded ſalt, or vitriol, of the water was ſhot into pretty figures, but all irregular; they looked all like a ſmall heap of little ſticks, laid a-croſs each other at all angles and poſitions; only they were tranſparent, and a little greeniſh, as cryſtals of a chalybeate nature uſe to be. He infuſed whole pepper-corns, bay-berries, oats, barley and wheat in water, whoſe ſcum, after two or three days, afforded animals, as had been already found by others, at leaſt as to ſome of them; but he found the greateſt numbers and variety in wheat and barley-water, and the feweſt in that wherein bay-berries had been ſteeped.

How ſuch vaſt numbers of animals can be thus, as it were at pleaſure, produced, without having recourſe to equivocal generation, ſeems a very great difficulty to account for; but tho' the ſolving of it that way makes ſhort work of the matter (for it is eaſy enough to ſay they are bred there by putrefaction) yet the aſſerting equivocal generation, ſeems to Mr. *Harris* to imply more abſurdities and difficulties than perhaps may appear at firſt ſight; he wiſhed therefore, that this matter would imploy the thoughts of ſome ingenious and inquiſitive men; in the mean time he conjectured, that theſe *Animalcula* may be produced by one or both of the following ways.

1. Mr. *Harris* was of opinion, that the eggs of ſome exceeding ſmall inſects, which are very numerous, may have been laid or lodged in the *Plicæ* or *Rugæ* of the coats of the grain, by ſome ſpecies of inſects that inhabit thoſe ſeeds, as their proper abodes; for that inſects of the larger kind do frequently thus depoſite their eggs on the flowers and leaves of plants, is often experienced; and it is very probable, that the ſmaller, or microſcopical inſects do the ſame; now theſe being waſhed out of the ſeeds by their immerſion in water, may riſe to the ſurface, and there be hatched into thoſe animals, which we ſee ſo plentifully to abound therein.

2. Or the ſurface of the water may detain the ſtraggling eggs of ſome microſcopical inſects, that perhaps were floating in the air; and being fitted and prepared for this purpoſe, by the infuſion of proper grain, or a proportionable degree of heat, may compoſe ſo proper a *Nidus* for them, that they may by the warmth of the ſun

ſun, be eaſily hatched into living creatures; which, it is probable, may afterwards turn into flies, or winged inſects of the ſame ſpecies with the animal-parent; and perhaps, ſometimes both theſe circumſtances, and others of the like nature concur for their production.

The great Age of Henry Jenkins; *by Dr.* Tancred Robinſon. Phil. Tranſ. N° 221. p. 267.

HENRY Jenkins died *December* 8th, 1670, at *Ellerton* on *Swale* in *Yorkſhire*; he was about 12 years old when the battle *Flowdenfield* was fought, which happened *September* 9th, 1513; ſo that he lived 169 years; *viz.* 16 years longer than old *Parr*. In the laſt century of his life he was a fiſherman, his diet was coarſe, but towards the latter end of his days he begged up and down; he had ſwore in chancery, and other courts, to above 140 year's memory, and was often at the aſſizes at *York*, whether he generally went on foot; and Dr. *Robinſon* was told by ſome of the country gentlemen, that *Jenkins* frequently ſwam the rivers after he was paſt the age of 100 years.

Microſcopical Animals; *by Mr.* Steph. Gray. Phil. Tranſ. N° 221. p. 280.

MR. *Gray* obſerved in hemiſpherules of water duly applied to the end of a wire, two ſorts of microſcopical inſects, globular and elliptical. Thoſe of a globular form are but a little leſs tranſparent than the water they ſwim in; they have ſometimes two dark ſpots diametrically oppoſite, but theſe are rarely ſeen; there are ſometimes two of theſe globular inſects ſticking together; where they were joined, it was opaque; they have a two-fold motion, a ſwift progreſſive irregular one, and at the ſame time a rotation on their axes at right angles to the diameter that has the dark ſpots; but this is ſeen only when they move ſlowly; they are almoſt of an incredible minuteneſs. Mr. *Gray* examined many tranſparent fluids, as water, wine, brandy, vinegar, beer, ſpittle, urine, *&c.* and he does not remember to have found any of them without more or leſs of the bodies of theſe inſects; but he did not obſerve any motion except in common water, that has ſtood for ſometimes a longer, at other times a ſhorter time, as has been obſerved by M. *Leewenhoeck*, tho' Mr. *Gray* does not remember that he had obſerved that they exiſt in the water before they revive; in the river, after the water has been thickned by rain, there are infinite numbers of them, that the water ſeems in a great meaſure to owe its opacity and whiteneſs to thoſe globules; rain-

rain-water, as ſoon as it falls, has many, and ſnow-water has more of theſe globules; the dew, that ſtands on glaſs-windows, abounds in them; and in regard rains and dews are continually aſcending or deſcending, Mr. *Gray* is of opinion, that the air is full of them; they ſeem to be of the ſame ſpecific gravity with the water they ſwim in, the dead remaining in all parts of the water; of many thouſands Mr. *Gray* obſerved, he could diſcern no ſenſible difference in their diameters, they appearing of equal bigneſs; in water that has been boiled, they retain their ſhapes, and will ſometimes revive. There is another ſort of inſects, but not ſo frequently to be found, at leaſt in winter; they are much longer than the former, can transform themſelves into many ſhapes, are for the moſt part elliptical, but ſometimes they contract themſelves ſo as to become almoſt globular; and ſometimes they extend themſelves in ſuch a manner, as to be twice or three times longer than broad; theſe ſometimes turn themſelves round on their axes and diameters as they go; they conſiſt of tranſparent and opaque parts.

The Uſe of Opium *amongſt the* Turks; *by Dr.* Edw. Smith. Phil. Tranſ. N° 221. p. 288.

ONE *Muſtapha Satoor*, an inhabitant of *Sediqui*, a village ſix miles from *Smyrna*, by trade a coffee-man, about 45 years of age, a moſt famous opium-eater, told Dr. *Smith*, that his conſtant doſe was three drachms a-day of crude opium, one half of which, he took in the morning, and the other half in the afternoon; but that he could ſafely take double that quantity.

Dr. *Smith* therefore, reſolving to be an eye-witneſs of what he could do, provided the beſt opium he could get, and weighed it nicely into drachms; of which the *Turk* took a drachm and a half, made up into three pills, and chewed them with a little water; the viſible effects the opium had on him were to make his eyes ſparkle, and give a new air of life and brightneſs to his face; at 3 o'clock in the afternoon he came to the doctor again, and took the ſame quantity as in the morning, and appeared after it with the ſame ſymptoms, alledging that it had always the ſame effects upon him, giving him vigour and ſpirit, and that it was become as neceſſary to him as any other part of his ſuſtenance, that it made him fitter for procreation, that it never affected him with ſleep and drowſineſs, but rather hindered his repoſe, when he happened to take an over-doſe; that he had uſed it for 25 years, beginning with the bigneſs of a grain, and gradually proceeding

to

to larger quantities, and that the want of it, and the desire of taking it grew daily upon him.

The effects it had on his health were, weakness, small legs, gums eaten away, so that the teeth stood bare to the roots, his complexion was yellow, and he appeared older by 20 years than he really was.

Opium is commonly taken by the messengers in *Turky*, who are employed in making quick dispatches; it is generally part of their provision, they take it when they find themselves weary, and it gives them strength and spirit to proceed.

The *Turks* use opium made up with something, that renders it palatable, at their feast called *Bairam*, to make them cheerful; which may be one reason of its prevailing so much; for finding that it then inspires them with agreeable fancies, they are tempted to continue it, and so its use becomes necessary, and grows upon them.

The Effects of strong Imagination; *by Dr.* Cyprianus. Phil. Trans. N° 221. p. 291.

A Female child was born with a wound in her breast, above four fingers long, it penetrated to the *Musculi intercostales*, and it was at least an inch broad, hollow under the flesh round about the wound; besides that, there was a contusion with a little swelling at the lower part of the wound in the inside; the child came into the world without any violence, and consequently it did not receive this wound in its birth, but it was caused by strength of imagination; for about two months before, the mother had by chance heard a report that a man had murdered his wife, and with a knife had given her a great wound in her breast; at which relation she changed, but not excessively.

It is probable, that the child received the wound in its mother's body at that very moment that she was affrighted, because the wound was very sordid, and the inside, as well as the outside, was beset with slime, proceeding from the water wherein the child lies in its mother's womb, and it was also like an old wound.

Strange Beans *frequently cast a-shore on the* Orkneys; *by Dr.* Sloane. Phil. Trans. N° 222. p. 298.

THERE is an uncommon sort of beans thrown up in great numbers by the sea on the islands on the north-west parts of *Scotland*, especially those most exposed to the waves of the

the great ocean, and they are no otherwiſe regarded than as they ſerve to make ſnuff boxes.

There are four ſorts of them; the firſt is what is commonly called at *Jamaica*, *Cocoons*; by Dr. *Sloane*, *Phaſeolus maximus perennis, folio decompoſito lobo maximo contorto*; it grows in both the *Eaſt-* and *Weſt-Indies*; it is alſo ſaid to be thrown up on the coaſt of *Kerry* in *Ireland*; the ſecond ſort is what, in *Jamaica*, they commonly call the *Horſe-eye-bean*, from its reſemblance to the eye of that animal, by means of a *Hilus*, or welt, which almoſt ſurrounds it; this alſo is common in ſeveral parts of the *Eaſt-* and *Weſt-Indies*; the third kind is that, which in *Jamaica* is called *Aſh-coloured Nickar*, from its being perfectly round, and very like a *Nickar*, ſuch as boys uſe to play withal; this is alſo common in the hot parts of the *Eaſt-* and *Weſt-Indies*; the fourth ſort is the *fructus exot. orbicularis ſulcis nerviſque diſtinctus quatuor, ſeu fructus alter ſplendens, 4 ſulcis diſtinctus*, C. B. authors are ſilent as to the place of its growth.

It is eaſy to conceive, that the beans, growing in the woods in *Jamaica*, ſhould fall from the trees into the rivers, and be thence conveyed into the ſea; it is alſo eaſy to believe, that being in the ſea, and floating therein in the neighbourhood of that iſland, they may be carried from thence by the wind and currents, which is there conſtantly eaſt, and being ſtopped by the main continent of *America*, is forced, thro' the gulph of *Florida*, or canal of *Bahama*, into the northern *American* ſea; for the *Lenticula marina ſerratis foliis*, *Lob*, or *Sargaſſo*, grows on the rocks about *Jamaica*, and is carried by the winds and currents, which for the moſt part go impetuouſly the ſame way, towards the coaſt of *Florida*, and thence into the northern *American* ocean, where it lies very thick on the ſurface of the ſeas; but how theſe beans ſhould come the reſt of their way, is not ſo eaſy to determine, unleſs we ſuppoſe that being carried northwards by the current from the gulph of *Florida*, they ſhould fall in the way of the weſterly wind, which generally blows at leaſt two parts of three of the whole year, and they may be ſuppoſed by this means at leaſt to arrive in *Scotland*. And it is reaſonable to think that the winds and currents brought from *America* to the *Azores* and *Porto Santo* thoſe ſeveral things, which are recorded by *Fernandez Colon*, in the life of his father *Chriſtopher*, to be ſome of the reaſons that moved the ſaid *Chr. Columbus* to attempt the diſcovery of the *Weſt-Indies*.

A large diſeaſed Kidney; *by Mr.* Will. Cowper. Phil. Tranſ. N° 222. p. 301.

A Young woman, about eight years before her death, felt ſome ſmall pain in the lumbal regions, and ſhe ſometimes made blackiſh urine; if at any time ſhe uſed any motion, the pain would encreaſe, commonly finding moſt eaſe when her body was at reſt; in this indiſpoſition, her phyſicians in the country preſcribed aſtringent medicines; about two years after, the lumbal pain encreaſed on the left ſide, and a great weakneſs, loſs of appetite, and bad digeſtion enſued; of theſe diſorders ſhe recovered again, and was, in all appearance, healthful, and ſo continued near two years and a half; about which time they recurred again, together with black urine, and frequent irritations to vomit; but of theſe diſorders ſhe had ſome intermiſſions, and ſo ſhe continued about two years. About *Chriſtmas* 1695, ſhe began to be afflicted with violent pains, and her urine appeared very black; of theſe extraordinary pains ſhe was much eaſed by the uſe of common clyſters, but notwithſtanding ſhe continued very much weakned; the beginning of *May* her pains encreaſed about the regions of the loins and *Pubes*, and ſhe was once or twice ſurpriſed with the falling down of a weight within her, as ſhe expreſſed it; when thus tormented ſhe took large doſes of opium, which ſomewhat elleviated her extraordinary pain; the ordinary poſition of the trunk of her body was more inclining to be erect than bending forwards, contrary to what we obſerve in thoſe troubled with the ſtone in the kidneys or *Ureters*, except thoſe in whom the kidneys are tumified. She complained of a *Stupor*, or numbneſs in the left region of the loins, whilſt very acute pains affected the *Viſcera* of the lower belly, eſpecially thoſe placed in the *Hypochrondia*; the pain in her *Pubes* increaſed near the time of her death, and a great *Stupor* affected the left thigh, which ſhe was ſcarcely able to draw after her, much leſs to put forwards in walking.

Upon opening her body, which was very much emaciated, a large tumour appeared in the left *Ilia*, extending itſelf to the left part of the *Epigaſtrium*, even to the *Hypochondrium* of that ſide; the *Omentum* appeared very thin and membranous, cleaving to the left kidney, which was very much tumified, and cauſed that appearance of a large tumour before diſſection; this kidney had taken place of the ſpleen, and touched the bottom of the ſtomach, and in ſuch a manner preſſed one part of

of the *Colon*, as very much to leſſen the diameter of that gut; the ſtomach and ſmall guts were ſomewhat diſtended with wind; the former appeared very looſe, as if its proper tone was much relaxed; the *Pancreas* appeared a little hardened; the left ſpermatic vein was much diſtended, between the kidney and the *Ovarium*, the upper part of that vein being compreſſed by the ſuperincumbency of the lower part of that kidney; inſomuch that the trunk of this ſpermatic vein was very much leſſened, immediately before it enters into the left emulgent vein; in diſentangling this diſeaſed kidney from its many adheſions to the neighbouring parts, its external membrane happened to burſt in two or three places, whence iſſued a large quantity of grumous blood; this kidney weighed five pounds, and the other but five ounces, which was of a common ſize, and no ways diſordered; by the diſtenſion of the membranous parts of the kidney itſelf, its veins were in a great meaſure compreſſed; its *Ureter* was become large by the intumeſcence or thickening of its ſides, whereby its cavity was ſtraitned; in a diviſion made by cutting into the body of this ſwelled kidney, its inſide appeared like that of a ſcirrhous or boiled liver. Mr. *Cowper* found two or three large cells, filled with grumous blood, which proceeded from a rupture of ſome blood-veſſels before death, which Mr. *Cowper* was apt to think might alarm the patient with the apprehenſions of ſome weight falling down, as ſhe expreſſed it. In the *Vagina Uteri*, near the *Meatus urinarius*, there was an ulcerous appearance, attended with a mortification; the left *Pſoas* muſcle was very much leſſened by the compreſſion of the lower part of that kidney; and the nerves, diſtributed to ſome parts of the thigh, which paſs thro' that muſcle, were expoſed to view.

No diſorder appeared on the *Thorax*, but what is commonly obſerved after death in all chronical diſeaſes; *viz.* a *Polypus* in each ventricle of the heart, and great blood-veſſels; and Mr. *Cowper* commonly obſerved *Polypi* in the right ventricle and the veins, eſpecially the *Vena Cava* and right auricle, the latter of which he found completely diſtended with a *Polypus*, or coagulation of *Serum* in the body of a boy, who died of a *Hydrops thoracis*; in which caſe, he found the ſymptoms of ſighing and difficulty of reſpiration never to fail; and he thinks the ſlow return of the blood by the veins, is the immediate cauſe of the coagulation of the ſerous part of the blood, which frames theſe bodies, which from the figure, they acquire from the parts they are lodged in, are called *Polypi*; hence it is

the *Syſtole* of the heart prevents their being framed ſo large in the left ventricle and arteries, as in the right ventricle and the veins; the blood being carried thro' the former with much greater force than the latter.

Blackiſh urine, Mr. *Cowper* thinks, is commonly obſerved in many feveriſh indiſpoſitions, where the blood is either partially obſtructed in its return by the veins of the kidneys, or thro' its great velocity in paſſing the kidneys, when ſome part of the globules of the blood alſo paſſes out at the urinary pores in the ſides of the blood veſſels; and theſe globules, being broken, exhibit thoſe blackiſh bodies, which appear in the ſediment of the urine; in theſe caſes, the *Serum* of the blood paſſes off with the urine; for by evaporating ſuch urine by heat, it will become thick, like the true *Serum* of the blood.

Obſtructions commonly begin in the moſt capillary veſſels, firſt, as Mr. *Cowper* frequently obſerved in viewing the tranſparent fins of divers living fiſhes with a microſcope; and tho' it has been hitherto commonly ſuppoſed, that veins and arteries are all equally leſſened at their extremities, yet Mr. *Cowper* is of opinion, that the extremities of divers blood-veſſels are much larger than their fellows; hence we may account for the partial circulation of the blood, and yet mortifications not neceſſarily enſue, as in the preſent caſe; for the kidney here being vaſtly diſtended, occaſioned by a retardation of the refluent blood and *Lympha*, it is conceivable that the obſtructions began in the membranes, which compoſe the *Parietes* of the trunks of the veins and lymphæducts, whence an intumeſcence neceſſarily follows, and the cavities of theſe veſſels are leſſened; conſequently the refluent blood or *Lympha* not being duly diſcharged, thoſe larger veſſels are neceſſarily diſtended between their tumefied ſides with compreſſed cavities, and their extremities at the arteries; thus we may apprehend how a part remains tumefied under a partial circulation, and may (when no bad juices taint the blood and *Lympha*) continue ſo for ſome months, nay years, as in the preſent caſe, without any diſorder to the patient, but on ſuch motions of the body, as accelerate the motion of the blood at the extremities of the veſſels, when there is a greater quantity of blood than can be diſcharged by the veins; whence a ſudden intumeſcence ariſes, and pain neceſſarily enſues. What aſtringent medicines avail in ſuch like caſes, is difficult to conceive, but aperitives might be ſerviceable. Loſs of appetite, bad digeſtion, *&c.* accompany nephritic caſes, on account of the com-

communication of the nerves of the kidneys with the ſtomachs, &c. whence the tone of that part, as well as the inteſtines, eſpecially the *Colon*, becomes vitiated, and ſubject to frequent diſorders, eſpecially vomiting and cobic pains; by the tone of that part, Mr. *Cowper* means, that proper diſtribution of the nervous ramifications within the part when diſtended, as in this caſe, and inteſtinal ruptures, and the like; or when the nervous ramifications are relaxed, as in paralytic caſes, &c. the tone of the part neceſſarily becomes vitiated, in as much as its nervous diſtributions are diſordered. The contents of the ſtomach and guts, not being duly carried on, are apt to ferment; the contained air being rarified by the natural heat, the inteſtines become very much diſtended, whence cholic pains ariſe; ſo by procuring the evacuation of this contained wind, the patient is relieved, as by adminiſtring clyſters, &c. In order to diſcover the operation of opium, and how it procures eaſe in this and ſuch like caſes, Mr. *Cowper* examined a ſolution of opium with a microſcope, and the particles of the diſſolved opium appeared like fringed globules; and theſe particles, conveyed to the maſs of blood, may be ſo entangled in its *Serum*, and thicken it in ſuch a manner, as to retard the progreſſive motion at the extremities of the blood-veſſels; hence the blood, not paſſing with its wonted velocity, does not ſo ſuddenly diſtend thoſe enlarged veſſels, which have a conſiderable ſhare in the intumeſcence of the part; but by making the globules of the blood paſs more calmly, may prevent their ſudden effors or intruſions into thoſe diſtended veſſels.

The tumefied kidney did not only compreſs the left ſpermatic vein, whereby the refluent blood of the *Uterus*, *Vagina*, and parts adjacent, was in ſome meaſure retarded, but ſome of the nerves of the *Vagina*, and thoſe of the *Pudendum*, were alſo compreſſed thereby; hence there is a pain from inflammation, thro' a retardation of the blood at the extremities of the vaſt number of blood-veſſels about the *Meatus Urinarius* at its egreſs in the *Vagina*, whence an exulceration and a mortification enſued; the magnitude of this kidney prevented the bending forwards of the body, and ſo ſhe was obliged to hold it erect; the lower part of the left kidney had ſo compreſſed the left *Pſoas*, as ſcarcely a third part of its proper bulk remained; whence neceſſarily followed a great weakneſs in drawing the thigh forwards; ſhe had a great *Stupor* in that thigh, by a compreſſion of the lumbal nerves, which lay expoſed immediately under the tumefied kidney.

Mr. *Cow-*

Mr. *Cowper* was apt to think, that ſuch like caſes are often taken to proceed from ſtones in the kidneys or *Ureters*; but he thinks, that unuſual poſture of keeping the body erect, may diſtinguiſh it, together with a weakneſs of drawing the thigh and leg forwards; if theſe ſymptoms do not conjointly occur, yet by this we may underſtand, that nephritic diſorders are not, as is commonly thought, owing to ſtones, either in the kidneys or *Ureters*.

A Fœtus *lying without the* Uterus *in the* Belly; *by M.* Saviard. Phil. Tranſ. N° 222. p. 314.

A Woman big with child came to *l'Hotel Dieu* to lie in of her third or fourth child, and after exceſſive pains about the navel and the lower part of the belly, by the different motions of the child, ſhe died there; upon opening her, the child was found dead, and not in the *Matrix*, which was entire, but near it; having examined the body with attention, all the parts of the *Uterus* both internal and external, as alſo the *Vagina*, were very ſound; the *Uterus* was as large as it uſes to be in women 10 or 12 days after they are brought to bed; the internal orifice was of a livid colour; there was no ſign of a *Cicatrix* or hole, but thoſe of the proceſſes, called *Tubæ Fallopianæ*, which yet were hardly wide enough to admit of a hog's briſtle. All the ſpectators agreed, that the child was never conceived in the *Uterus*, and that it never had ſtaid there. The right teſticle, or ovary, was very ſound, but the *Tuba* and its fringe were rotten in the place where it is faſtened to the membranes of the *Peritonæum*, which formed the bag in which the child was wrapt; the left teſticle was of the bigneſs of a hen's egg, full of a fetid *Serum*, the ligaments were large, and the *Tuba* and its fringe were rotten; the bag was placed betwixt the *Matrix* and the ſtraight gut, in the cavity formed by the bending of the *Os Sacrum*; the child was on its knees, lying towards the right ſide, and ſeemed to have been dead 7 or 8 days; the child had left the *Placenta*, tho' ſtill faſtened to it by the umbilical veſſels; and the *Placenta*, being out of the bag, was on the left ſide, whence was voided a great quantity of blood into the cavity; its edges, being brought near to each other, repreſented a bowl, ſuch as they play at nine-pins with; all the membranes, that formed this bag, and all thoſe that encompaſſed it were gangrened.

Obſer-

Observation on a Woman *who died of a* Dropsy *after the* Paracentesis; *by Dr.* Ch. Preston. Phil. Transf. N° 223. p. 330.

IN the dissection of Madam *Vaillant* by M. *du Linier* the liver was found very white externally, but sufficiently red within; the *Epiploon* was extremely dried; the stomach was much bigger than ordinary; the windings of the *Colon*, which pass under the stomach, were extremely drawn together; in the umbilical region, the *Jejunum* and *Ileum* were much inflamed, and their tunics thicker than ordinary; in the hypogastric region, all the inferior part of the *Ileum*, on that side near the bladder, and all the bottom of the *Matrix*, as also the lower part of the *Rectum*, were much inflamed and ulcerated; in the bottom of the *Matrix* there was an abscess, and the internal orifice was extremely dilated, about the bigness of a crown; the extremity of the inferior part of the *Ureter* was cartilaginous; the extremity of the *Tubæ Fallopianæ* went so high as the second *Vertebra* of the lumbar region; in the interior part it was dilated six lines, and about two inches near the bottom of the *Matrix*, and it was fastened to all the inferior part of the kidney; that of the left side was dilated about four lines in the upper part, and six in the inferior. The right testicle, or *Ovarium* which does not ordinarily exceed the bigness of a pigeon's egg, was here three inches long, and two broad; and in the inferior part, there was found an egg, hanging by its ligament, out of the *Tuba Fallopiana*, about the bigness of the yolk of a common hen's egg, which, for experiment, was boiled, and it hardened like an ordinary egg; the right kidney reached up as high as the last of the true ribs, and descended below the umbilical region; the *Pelvis* was dilated about three inches in breadth, and seven in length; the greatest part of the water had run out in the operation of the *Paracentesis*. The lungs were of a livid colour, as in all chronical distempers, and on the right side they adhered to the *Pleura*, and on the left side there was an adhesion of the inferior lobe to the diaphragm; there was little or no *Serum* in the *Pericardium*, and what was found therein, was of a bloody colour; in dissecting the heart, there was a great *Polypus* in the right ventricle, which took up almost all the cavity, about 5 or 6 lines in thickness, and half a foot in length.

From what has been said, it appears impossible that this patient could have recovered, tho' the operation had been performed; only this is to be remarked, that where the dropsy is of a long continuance, and the patient's much debilitated, and aged,

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in that caſe the operation ſhould not be performed; for generally the *Viſcera* are corrupted. When you find it adviſable to perform this operation, extract the water by degrees, and not all at once, elſe you endanger the patient's life; for ſcarcely does one in a hundred eſcape, that is otherwiſe managed.

The true cauſe of the dropſy Dr. *Preſton* takes to ariſe from the mechanical ſtructure of the parts, and the diſpoſition of the blood; which are, firſt, the relaxation of the fibres and pores of the veſſels, or the *Veſiculæ* between the arteries and the veins; or, ſecondly, a compreſſion of the veſſels; for the *Lymphatics* take their riſe from the membranes, which cover the muſcles, *Viſcera* and glands; therefore, when the *Veſiculæ* are too much ſtraitned with ſeroſity, their fibres loſe their natural force, and become uncapable of expelling the too great quantity of water; but the *Veſiculæ* are daily more and more enlarged, till their fibres ſuffer ſo great an extenſion as even to break; from hence is the ſource of theſe waters; it ſometimes alſo happens, that the pores of the ſaid *Veſiculæ* are ſo widened, that the *Lympha* runs out into the cavity of the belly, or the interſtices of the muſcles. The cauſe from the diſpoſition of the blood, is either when it is too thin, or too viſcid; too thin, that it paſſes eaſily thro' the pores of the veſicles; too viſcid, that it cannot paſs thro' the capillary veſſels, and by conſequence, it compreſſes the adjacent parts and ſo cauſes obſtructions.

The Way of Cutting for the Stone in the Kidneys; *by Mr.* Charles Bernard. Phil. Tranſ. N° 223. p. 333.

MR. *Hobſon*, who was Conſul for the *Engliſh* at *Venice*, having been long afflicted with the ſtone in the kidney, was at length attacked with a fit of that duration and violence, that it reduced him almoſt to deſpair; and finding no relief from any means that had been uſed, and being under the greateſt extremity of pain imaginable, he addreſſed himſelf to *Dominicus de Marchettis*, a famed and experienced phyſician at *Padua*, begging of him, that he would be pleaſed to cut the ſtone out of his kidney, being perſuaded that there remained no other method capable of relieving him; adding, that he was not inſenſible of the danger, but that death itſelf was infinitely more eligible than a life in that miſery; *Marchetti* ſeemed very deſirous to have declined it, repreſenting not only the extreme hazard, but, as he feared, the impracticableneſs of the operation; that it was what he had never attempted, and that to proceed to it, was in effect to deſtroy him; but *Marchetti* was at length prevailed upon by his

his importunity to undertake it; and having prepared him as he thought proper, he began with his knife, cutting gradually upon the region of the kidney affected, till the blood disturbed the operation, so that he could not finish it at that attempt; wherefore dressing up the wound till the next day, he then repeated and accomplished it, by cutting into the body of the kidney, and taking thence two or three small stones, he dressed it up again; from this instant he was freed from the severity of the pain, and in a reasonable time was able to walk about his chamber, having been in no danger either from a flux of blood or fever; *Marchetti* continued to dress the wound for a considerable time, but was not able to close it up, it soon becoming fistulous from the continual flux of the urine thro' the *Sinus*; but being in all other respects restored to his former health and vigour, and the matter discharged being little in quantity, he took leave of the professor, and returned to *Venice* under the care and management of his wife, who, one morning, as she was dressing the sore, imagined she felt something hard and rugged, as she wiped it; upon which examining a little more carefully with her bodkin, she found it to be a stone of the figure and magnitude of a date-stone; which being removed, he never after complained of the least uneasiness in that part. The matter discharged was but little in quantity, but always diluted with, and smelling strong of urine; the orifice would sometimes close for 3 or 4 days together, and then the matter would make its way thro' the common passages with the urine, yet without any difficulty or pain; he applied nothing to the orifice but a clean linnen rag; he was able to perform all the functions of life, and to undergo any fatigue, tho' upwards of 50 years of age.

Observations in Lincolnshire; *by Mr.* Chr. Merret. Phil. Transf. N° 223. p. 343.

THAT part of the country of *Lincoln*, that lies towards the sea, is a level about 50 miles long; *viz.* from *Grimsby* to *Crowland*, and 10 miles in breadth from the sea to the *Woulds* or *High-lands*. It may be divided,

1. Into marshes, extending from *Grimsby* to about *Waitfleet*, which abound in store of large sheep, which yield a very lusty wool, or of a large staple, as it is called, three or four fleeces usually making a tod of 28 pounds; several hundred loads are yearly carried out of it into *Norfolk*, *Suffolk*, the north and west countries in great packs, called pockets, of about 2500 *l.* weight, and there manufactured.

2. Fens, the eaſt begins about *Wainfleet*, and ends at *Sibſye*, yielding a great plenty and variety of fowl and fiſh, particularly, duck, mallard and teal, which are uſually taken in decoys, and ſent to *London*; about *Midſummer*, at moulting time, ſeveral perſons go in ſmall boats amongſt the reeds, and knock them down with long poles; thro' theſe fens run great cuts or drains, which abound in fiſh, eſpecially pike, ſome of which are very large; there are alſo vaſt flocks of geeſe; but both fiſh and geeſe taſte muddy and rank; but the geeſe, when fed with corn, eat as good as others; they are pulled for their feathers about ſix times a year, and thrice for their quills. Between *Spalding* and *Crowland* grow large crops of oats, as alſo large quantities of *Rapum Sylveſtre* called cole-ſeed, of which they make oil, by breaking it between two large black marble ſtones of near a ton weight, one ſtanding perpendicular on the other in mills, called oil-mills; ſome go with ſails, and ſerve alſo to drain the fens, and are called engines, and they diſcharge great quantities of water; after preſſing out the oil from the cole-ſeed, what remains is called cakes, which is burnt for fuel, and they heat ovens therewith; they are alſo exported to *Holland*, where they feed their kine with them.

3. Paſture-grounds, which lie between the ſea and the fens, are very fertile, feeding a great number of fat oxen and ſheep, which are weekly ſent in droves to *London*.

Near the fens ſtands *Boſton*, remarkable for its church, ſteeple and river; the church is very lofty, and cieled with *Iriſh* oak, neatly wrought, its body is 100 foot wide; the ſteeple is a tower of 285 foot high, octangular towards the top, of curious carved ſtone-work, ſtanding not above 12 yards from the river *Witham*, it is only 32 foot wide and 40 in length, at each angle is a large buttreſs; records mention its foundation to be laid 9 foot below the bottom of the river; the length of the church is equal to the height of the ſteeple; the pillars, which are very neat and ſmall for their height, the windows and ſtairs are equal in number to the months, weeks and days in a year; from its top *Lincoln* and *Lyn* may be ſeen, as alſo ſhips on the ſea at a great diſtance; it is a great land-mark, it being ſeen above 40 miles at ſea; the river is remarkable for good pike, according to the old rhyme;

An *Ankham* eel, and a *Witham* pike,
All *England* cannot ſhew the like.

It is alſo very rapid. They make ſome years 40, 50 or 100 ton of oil of a little fiſh, taken in this river, and called in *Latin Pungitius*, *Stickleback*, *Prickling* or *Baneſtead*, from the ſmall prickles on its back; they are not above an inch and a half long, and about half as broad; about a buſhel are taken at a draught, and about 8 chalder will make a hogſhead. The country people gather up the dung of oxen and cows, and temper it with water, and ſpread it on the ground about five inches thick, this they cut out into oblong pieces of about a foot, and call them *Dithes*, which they uſe for fuel; they alſo gather up hog's dung, and ſteep it in water, and having well ſtirred it, they ſtrain it, and ſo uſe it to waſh cloaths; which, when bleached in the ſummer, will become white and ſweet. Beſides the fowl mentioned by Mr. *Cambden*, of mudſuckers (which are eſteemed the beſt) they have *Ruff* and *Reve*, the former being the cock, the latter the hen, in *Latin Aves pugnaces*, becauſe they are continually fighting; rarely two in a hundred are of a colour, they are uſually mewed. As to fiſh, they have turbot in great plenty, called *Brets*, and taken in nets trailed on the ground by two horſes; they have large ſoals, taken in troul-nets, trailed by ſmacks under ſail as alſo great plenty of ſkate, which are taken with hooks lying near the ſhores, as are in like manner cod and thornback. As to inſects, gnats, here called midges, are in ſome places very troubleſome, ſome uſe ſilk-nets to ſecure themſelves from being bitten; frogs are very numerous here, called *Holland Waites*. As to vegetables, great quantities of hemp are ſown in ſeveral places, of which ropes are made, both for ſea and land; the female is called *femble*, as alſo *flax*; the ſeed is broken, and oil made thereof, as of cole-ſeed; the ſalt-marſhes yield a great deal of *Kali geniculatum*, which, when pickled, is their ſamphire; *Carum* grows plentifully in the paſtures, the ſeed they call ſaxifrage, which they gather and ſend to *London*. Theſe parts afford but little variety of metals, gums or ſtones; amber is ſometimes picked up on the ſand in pretty large pieces; the *Aſtroites*, found at *Belvoir* caſtle, will not only move in vinegar, but alſo dulcify it, and this *Lapis judaicus* will alſo do. Here coals are charred, and then called *Coak*, with which they dry malt, giving little colour or taſte to the drink made therewith; on the ſands the poor people ſweep together a ſmall black ſubſtance, of which they make fires, by leaving open a hole in their chimnies for the air to blow it; they have one on each ſide to open and ſhut as the wind ſits. Agues, called *Holland Baylies*, are here very rife, few ſtrangers eſcaping them. There are in ſeveral places a

great many hills thrown up, called *Burrows*, ſuppoſed to be ſepulchral monuments.

A Water Microſcope; *by Mr.* Stephen Gray. Phil. Tranſ. N° 223. p. 353.

A B Fig. 1. Plate VI. is the frame of the microſcope; it may be about $\frac{1}{10}$ of an inch in thickneſs; at A is a ſmall hole, near $\frac{1}{10}$ of an inch diameter, which ſerves for the aperture of the water, in the centre of a larger ſpherical cavity, about $\frac{1}{8}$ of an inch diameter, and in depth ſomewhat more than half the thickneſs of the braſs; oppoſite to this, at the other ſide, is another concave, only half the breadth of the former, which is ſo deep, as to reduce the circumference of the ſmall hole in the centre to almoſt a ſharp edge; in theſe cavities the water is to be placed, being taken up on a pin, or large needle, and conveyed into them till there is formed a double convex lens of water, which, by the concaves being of different diameters, will be equivalent to a double convex of unequal convexities; by this means, the object is rendred more diſtinct than by a plano-convex of water, or by a double one, formed on the plain ſurface of the metal; C D E is the ſupporter, whereon to place the object; if it be water, in the hole G; if a ſolid object, on the point F; this is fixed to the frame of the microſcope by the ſcrew E, where it is bent upwards, that its upper part may ſtand at a diſtance from the frame; it is moveable on the ſcrew as a centre, to the end that either the hole C, or the point F, may be expoſed to the microſcope, and that the object may be brought to, and fixed in its *Focus*. There is another ſcrew, about half an inch in length, which goes thro' the round plate into the frame of the microſcope A E, the ſcrew and plate taking hold of the ſupporter about D, where there is a ſlit, ſomewhat larger than the diameter of the ſcrew, which is requiſite for the admiſſion of the hole C, or point F, according to the nature of the object, into the *Focus* of the glaſs; for by turning the ſcrew G, the ſupporter is carried to, or from the ſame; which may be ſooner done, if whilſt one turns the ſcrew with one hand, the other hold the microſcope by the end B, and one continue looking thro' the water till the object be ſeen moſt diſtinctly. The ſupporter muſt be made of a thin piece of braſs well hammered, that, by its ſpring, it may the better follow the motion of the ſcrew; Mr. *Gray* choſe rather to fix the ſupporter by the ſcrew E, than by a rivet; becauſe it may now, by means of a knife, be unſcrewed, and by the other ſcrew G, be brought cloſe to the frame of the microſcope without weak-

Fig. I.

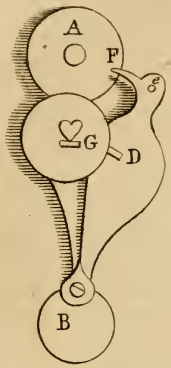


Fig. II. p. 199.

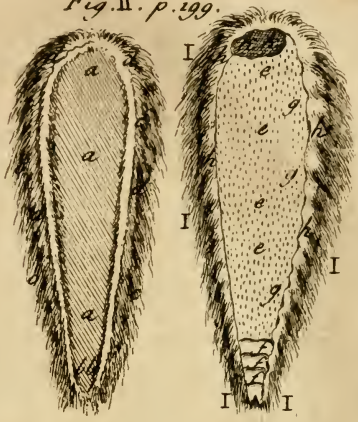


Fig. IV.

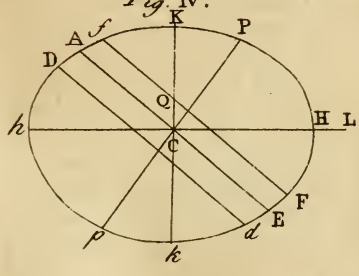


Fig. III. p. 203.

Fig. V.

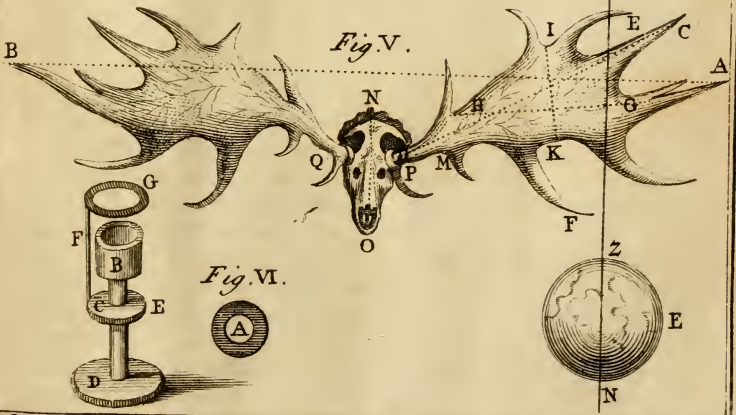


Fig. VI.

weakning its ſpring, and ſo become more conveniently portable; if the hole at G be filled with water, but not ſo as to be ſpherical; all objects, that will bear it, are ſeen therein more diſtinctly.

The Nature and Difference of the Juices *of* Plants; *by Dr.* Liſter. Phil. Tranſ. N° 224. p. 365.

WE obſerve generally, that the juices of plants do coagulate, whether they be ſuch, as are drawn from the wounds of a plant, or ſuch as do ſpontaneouſly exſudate; and yet that exſudation ſeems to be often accidental, that is, either by a cancer, or ſome other ſuch like accident.

The ſmall green leaves, which next encompaſs the yellow flowers of *Androſænum Hypericoides*, Ger. are beſet with very ſmall round blebs or bags, full of a purple juice, and the very points or tops of the yellowiſh leaves themſelves are furniſhed with two or three of them; yet the ſtalk, when cut, doth not to the eye, diſcover any ſuch diſtinct veſſels carrying that purple liquor; which made Dr. *Liſter* ſuſpect that it was ſeparated by coagulation from the reſt of the juice, and reſerved in thoſe ſmall bags. The purple bags in the *Hypericum*, Ger. are upon the edging, on the outſides of all the leaves; alſo the ſtalk, tho' round, hath a double edge, on each ſide one; and the bags, tho' but thinly, are yet obſervable on theſe riſing edges of the ſtalks; as for the yellow flowers themſelves, the outmoſt green leaves, which immediately encompaſs them, have but few purple ſtripes, but the yellow leaves or flowers are edged with ſmall purple bags on the one ſide, and ſtriped with purple veins on the other; laſtly, on the very tops of each thread in the flower, is one ſingle purple bag: In like manner all the edges on the outſides of all the leaves, from one end of the ſtalk to the other of the *Hypericum Aſcyron dictum, caule quadrangulo*, J. B. are very thick ſet with purple bags; alſo in the flower, all the threads have one ſingle bag on the top, but the flowers are yellow leaves, and the green ones encompaſſing them, have very few purple ſpots or ſtreaks viſible. The yellow flowers of the *Hypericum pulchrum traji*, J. B. and the green leaves, which next encompaſs them, are alone thick edged with purple blebs. Divers parts of the ſame plant have divers faculties, U. C. P. A. And Dr. *Liſter* adds, that divers parts of the ſame plant yield from the ſame veins different coloured juices, *v. g.* the milk in the root of *Spondylium*, Ger. is of a brimſtone colour, but it is white in the ſtalk.

Amongſt

Amongſt thoſe juices, that coagulate and are clammy, there are ſome which readily break with whey.

In the middle of *July*, Dr. *Liſter* drew and gathered of the milk of *Lactuca ſylv. coſta ſpinoſa*, C. B. which it freely and plentifully affords; it ſprings out of the wound as thick as cream, and is ropy and white; and yet the milk, which came out of the wounds, made towards the top of the plant, was plainly ſtreaked, or mixed with a purple juice, as tho' one had daſhed or ſprinkled cream, with a few drops of claret; and the ſkin of the plant was thereabouts purpliſh, poſſibly with veins: Again, it turned ſtill yellower and thicker in the ſhell into which it was drawn, and by and by it became curdled, that is, the white and thick cheeſy part was ſeparated from a thin purple whey; in like manner, the blood of animals, whilſt warm, continues liquid and uniform, but as ſoon as it becomes cold, it cakes, and has a *Serum* or whey, ſeparated from it; alſo the cheeſy part of the milk of animals is glutinous and ſtringy; further, this *Serum* came freely from the other, by ſqueezing between the fingers, and the curds, waſhed in ſpring-water, became tough, and continued ſtill white and dry; as for the purple whey, after ſtanding a day in the ſun; it became ſtiff and hard, and was eaſily formed into cakes, which were very brittle, and would eaſily crumble into powder. About *December* following, Dr. *Liſter* broke one of the cakes made of the cheeſy part of the milk of this plant; and it then proved very brittle, and ſhone, upon breaking, like roſin, of a dark-brown colour; beſides, it burned with a laſting flame, and melted by heat; it would draw out into long tough ſtrings, like bird-lime; on the contrary, the purpliſh powder, which was the whey, if put into the flame of a candle, would ſcarcely burn at all, but ſoon become a coal; laſtly, the purple powder taſted very bitter, whereas the cheeſy part was as inſipid as wax.

The milk, which the *Trachelium* kind plentifully yields, is very thick and preſently curdles, the ſerous part or whey, being of a brown colour; theſe juices ſmell ſour, ſomewhat like the ſlices of green apples, which have been long cut. The thin milk of *Tithymallus helioſcopius*, Ger. runs out freely and plentifully; it is very clammy upon the fingers, and very white in drawing; it turns upon a lancet of a dark blue, and ſhews of the colour and conſiſtence of blue ſkimmed milk; made up with wheat flower into cakes, it appears greaſy or oily, and ſcarcely ever becomes dry; it breaks, or coagulates, with

with difficulty. Dr. *Liſter* kept ſome of it pure and unmixed in little eſſence bottles, ſtopped lightly with cork only; in theſe it broke in proceſs of time, and the curds were eaſily to be formed into cakes, which burned with a laſting flame, and being melted, drew out into ſtrings like wax, the whey was clear like fair water; this broken milk in all the bottles was corrupted, and ſtunk; but the cakes made up of this juice, with wheat flower and a little gum-arabic, was well dried and kept ſweet.

There are other clammy juices, which do not ſeparate a whey, when they coagulate, but cake wholly: Dr. *Liſter* made cakes of the unmixed juice of *Sonchus lævis & aſper*, without any addition, and it did not ſeparate any whey.

Papaver Rheas, Ger. bleeds freely a white juice, and the heads or ſeed-veſſels, when the flower is gone, do ſtill continue to bleed; Dr. *Liſter* obſerved, that in gathering it into ſhells, its white colour preſently became yellow, inclining to an orange; at firſt ſpringing it roped, or was but little clammy, and ſeemed to be very liquid and dilute, yet it did not ſeparate any whey, but grew ſtiff; it is very reſinous and oily.

Note, the milks or juices of plants ſeem to be compounded, and mixed of liquors of different, and perhaps contrary qualities; ſo that it is probable, if the cheeſy part be narcotic, for inſtance, the whey may not be ſo; or the one may be hurtful, and the other a good and uſeful medicine.

Tragopogon flore luteo, J. B. yields a juice, which, upon the firſt ſpringing from the wound, is white and thick, but immediately turns yellow, and then redder and redder; it is of no unpleaſant taſte, is ſomething glutinous and oily, and ſeparates little, if any whey, and is therefore eaſily formed into cakes alone. *Convolvulus major*, J. B. bleeds freely a white juice, not only from the ſtalk and leaves, but alſo from the white flowers, as plentifully as from any other part; this milk is very ſharp.

There is alſo a juice of a ſaffron colour, which *Chelidonium majus*, Ger. wounded freely affords; this juice does not ſeparate a whey, but is eaſily formed into cakes, and ſtiffens in the ſun; it is thick, and of the conſiſtence of cream, as it runs out of the wound. There is another very clammy juice of a golden or yellow colour, upon drawing; and this liquor the ſeed-veſſels of *Centaurium luteum perfoliatum*, C. B. in *July*, and after, even where the ſeeds, therein contained, are turned black and ripe, yield plentifully and freely enough. Theſe juices,

Juices, which the heads, or ſeed-veſſels of plants afford, may be thought of the ſame nature with thoſe, which the pulp of fruit affords; the pulps of fruits, and theſe exterior veſſels being parts equivalent; that is, apples, for inſtance, are nothing elſe but the ſeed-veſſels of their kernels. This juice of *Centaury* is liquid upon the firſt drawing, and after a while it thickens, ſeparating no whey, and is of the colour of amber; it ſticks to one's fingers, and draws out into threads, like bird-lime; it would never become harder than very ſoft wax, and that by being dried in the ſhade only; for if ever ſo little expoſed to the heat of the ſun, or fire, it immediately becomes exceeding ſoft; but the cakes made up of it and wheat flower, were in winter become very hard and firm, and the unmixed cakes continued ſtill ſoft; they burn with an unpleaſant ſmell, emit a laſting flame, ſtill retain their amber colour, and draw out into threads in burning, like wax. To this we may add the yellow juice, which the wounds of *Angelica ſativa*, Park. yield; it will not harden by being expoſed to the ſun, or by being long kept, yet it becomes ſtiff, and draws out into threads.

The next ſort of coagulated, or clammy juices, are gums; and ſome of them ſeem to continue for a long time liquid, and perhaps inflammable; others there are which grow hard, and are not to be kindled into flame; they are eaſily diſſolved in fountain-water, and ſparkle when put into a flame; which two properties argue a ſerous or watry part in them; again, put into a flame, they melt, and become, as it were, liquid and ductile, which ſhews their cheeſy part, and becauſe they will not flame, it is an argument of their leanneſs and ſcarcity of oil; all theſe three things, put together, plainly evince gums to be coagulated juices.

In *Auguſt*, Dr. *Liſter* obſerved both the green and ripe cluſters of *Periclymenum*, Ger. very leaky; which upon a nearer inſpection he found to be a thin clammy juice, or liquid gum, which fell down upon the leaves, and retained its fluid form there; here the purple juice ſeems to be a whey ſeparated from the liquid gum, but Dr. *Liſter* rather thinks, it is a diſtinct liquor.

The red threads of *Rorella* end in little bags, which, being compreſſed, yield a purple juice; and theſe ſmall buttons are encompaſſed with ſmall tranſparent pearls, or drops of a liquid gum; they continue in this form the hotteſt day in ſummer like dew, whence alſo the plant has its name, and upon the leaſt touch

touch they cleave to the fingers, and draw out into long threads like bird-lime. In like manner a liquid gum is obſervable on the *Pinguicula*; *Note*, that the ſmall drops and threads, or hairs in either of theſe two plants, are to be ſeen upon the uppermoſt or inmoſt ſide of the leaf, and the outmoſt and undermoſt ſides are ſmooth or void of them; which is contrary to what is obſerved in other plants. About the middle of *Auguſt*, the chats of the alder ſeemed to be gummy; perhaps this gum did exſudate from the plant itſelf; as probably the honey-fall, or gummy dew on the leaves of the oak, *&c.* are nothing other.

The *American* or *Indian* rhubarb, ſown in our gardens, is the only plant Dr. *Liſter* ever obſerved to yield a gum clear and hard, which it exſudates from all parts of the ſtalk and ribs on the under ſide of the leaf itſelf; he gathered ſome in form of pretty large drops, others as tho' the ſtalk had been beſmeared therewith, and others ſhot into long and twiſted wires or icicles; beſides, he obſerved, that the cankered orifices, or places, at which the gum had burſt forth, could be traced with a knife into the ſtalk; and that thro' the ſkin, in certain places, the juice within the plant was become gummy, and looked like clear water. It is the experiment of Mr. *Fiſher*, that the clear and defecated juices of moſt plants have more or leſs redneſs in them; again, that the dried root of *Acetoſa* (a plant of the ſame family with rhubarb, which may probably be called the *Indian* ſorrel, or ſour docken) boiled, dies water of a fair red colour; and Dr. *Liſter* obſerved, that the huſks of the unripe ſeeds of rhubarb yield a very fair and deep purple; *Note*, that rhubarb, ſorrel, *&c.* do, when they decay, turn red. The juice extracted from the roots of our *Engliſh* rhubarb, by a tincture of fair water ſteamed away, is nothing elſe but a lean uninflammable gum; and tho' it differ in colour, as being of a deep liver colour, from the exſudating gum, yet in other properties, as this of being uninflammable, ductile in the flame of a candle, *&c.* it agrees therewith; this gum is ſweet, or rather inſipid. To this purpoſe, Dr. *Liſter* obſerved, in ſummer-time, even the juice of apples ſpontaneouſly gellied in *Languedoc*, and the apples looked clear and hard like ice; whence they call that ſort of apple, *Pome gelée*, or the frozen apple; tho', in reality, it be nothing elſe but the breaking or coagulating of the juice in ſome ſpots of it; for it is rare to ſee one of them all over ſo. We may here give a probable reaſon, why a gentle infuſion or

maceration of rhubarb is a very ſure purge, but the ſubſtance or powder of rhubarb, or a decoction thereof, will have a quite contrary effect, and bind; the ſharp and tart juice in rhubarb, wherein its purging quality lies, is by a gentle infuſion ſo extracted, that it turns not to gum in our ſtomachs.

Green plumbs and ſloes do often exſudate a gum, which is clear and tranſparent. *Lauro-ceraſus*, a beautiful winter-green, which we have adopted to adorn our court-walls with, yields a clear gum very plentifully; it is very white, and very clear.

Dr. *Liſter* wrenched and wounded the holly, the latter end of *March*, and yet after ſome days of warm and open weather, he could not perceive the leaſt ſtirring of juice; the latter end of *May*, the bark begins to be full of lime or ſtringy juice, which you may try by preſſing a piece of it betwixt the fingers, and when you would take them off, the juice or lime draws out into hairs; this lime is ſeparated from, or taken out of the bark thus; peel off the bark in *May*, *June*, or *July*; for then it comes eaſily away, and moſt abounds in juice; boil the bark in fair water, till it be ſo tender, that the outmoſt thin grey bark or membrane, will peel off eaſily; lay it ſo peeled, and cover it over with green nettles, fern, or ſuch like, in layers, in a cellar for about ten days, where it will ferment or rot, and become mouldy; take them out, and beat them well in a mortar to a paſte, and roll them up into ſmall hand-balls, and in a running ſpring waſh them clean from all the woody parts, which is done by pulling and teazing them. In cutting the tender tops of elder, the latter end of *May*, there will run out a ſtringy juice, ſomewhat like bird-lime, or the juice of holly; it ſeems to be contained in certain veins, juſt within the circle of teeth or wood.

The diſſected veins of many plants afford an oil, that is, ſuch a juice, which, being rubbed between the fingers, is not at all clammy, but makes them greaſy; you may take off with a clean knife the juice of *Helenium* or *Enula campana*, J. B. and it looks like oil mixed with water; the ſame experiment may be made on *Cicuta*; the juice of *Angelica Sativa*, Park. after a few years keeping was grown very limy. If in *June* you ſtrip off the leaves of *Tapſus barbatus*, Ger. it ſeems to yield an oily juice, but much diluted with water; it ſprings freely and enough, is of a dark green colour. The fruits of many plants afford oil, as olives, the berries of laurel, ivy, juniper, female cornel, or dog-tree, &c. The pulp of moſt ſeeds ſeem

to

to abound in this oily juice; and at ſome times before maturity, it is liquid and viſible in them in the form of a milk. The latter end of *May*, the ſeeds of the *Helleborus Niger Sylv. Adulterinus etiam hyeme virens*, J. B. are very milky, and by being expoſed to the ſun are eaſily formed into cakes, which are very oily, and being long kept, and expoſed to the flame of a candle, they burn freely; this milk or juice of the ſeeds is of a very fiery and pungent nature.

There are very oily juices, which after coagulation harden, and are called roſins; and ſuch ivy yields plentifully; to this alſo may be referred the juice of *Juniperus vulgaris, baccis parvis purpureis*, J. B. which is a hard fat juice, and not very gummy. There was an exſudation of a thick, yellowiſh, and greaſy matter, like barm, from the chops of ivy made in *March*; it melted like oil between the fingers, without the leaſt perceivable clammineſs; in proceſs of time it hardened and cruſted on the wounds, like coarſe brown ſugar; it burns with a laſting flame, and ſmells very ſtrong: Alſo on the topmoſt leaves of *Lactuca ſylv. coſtâ ſpinoſâ*, C. B. in *July*, many ſmall drops, or pearls of an oily juice, like coagulated, or hardened roſin, are plainly to be diſcerned, eſpecially with a ſingle microſcope; they are of an amber colour, and tranſparent, eaſily to be wiped off, as being an oily exſudated juice. And Dr. *Liſter* is of opinion, that even the blue flower of ripe plums, is nothing other but a fine reſinous coagulation of the tranſudated juice. On the under ſide of the leaves, and all over the ſtalk of *Bonus Henricus*, J. B. there ſtick infinite ſmall tranſparent pearls; theſe clear drops are hard to the touch, and feel like greaſy ſand, and not clammy; therefore it was well called unctuous by *Caſpar Bauhin*; and this ſpontaneouſly exſudated juice is reckoned amongſt the reſinous coagulations.

The juices of plants are alſo varied and diſtinguiſhed by fermentation; and not only the juices of fruits are to be wrought, or ſet a working; as of the apple, pear, briar, grape, &c. as is well known; but there is an artificial change, *viz.* malting, to be made even on the ſeeds of plants, ſo as to make them ſpend freely, or diſcharge their juices, and communicate them to common water, and receive a ferment; alſo the juice of liquorice will ferment, and that of cane, as ſugar; again, the tapped juices of vegetables are ſuſceptible of a fermentation.

An Hydrops Pectoris; *by Mr.* Sam. Doudy. Phil. Tranſ. N° 224. p. 390.

A Noble peer had for many years been troubled with an extraordinary ſhortneſs of breath; his lordſhip was always better in bed, or lying, than ſitting or ſtanding; quite contrary to other aſthma's, in which the patient is not able to lie down; the muſcles of the breaſt having a freer motion, when in an erect poſture. Upon opening the body, both the cavities of the breaſt were found full of water, which, when ſtanding or ſitting, preſſed in ſuch a manner on the diaphragm, that reſpiration was performed with difficulty; but in a lying poſture, that floating load was ſo diſpoſed, that that function was better performed; this ſeems to be ſo natural a ſymptom, that it may be almoſt an infallible diagnoſtic, to diſtinguiſh an *Hydrops Pectoris* from other more frequent diſeaſes of the breaſt, that cauſe a ſhortneſs of breathing. Perhaps it may not be impracticable to uſe the *Paracenteſis* in the like caſe, when the diſeaſe is certainly known, and without it death is moſt likely to enſue.

A Scolopendra Marina; *by Dr.* Tho. Molyneux. Phil. Tranſ. N° 225. p. 405.

IN *December*, 1696, two remarkable ſea-animals were found in the ſtomach of a common cod-fiſh, ſold in the fiſh-market in *Dublin*; one of them, by lying long in the ſtomach, was much mangled, and in part digeſted; but the other was complete in all its parts, and had undergone no manner of change, ſave that it was dead; it was bigger at one end, and went tapering, or gradually leſſening towards the other; it was four inches and ſix tenths in length; and where largeſt, as it was one inch and one tenth broad, ſo it was about three inches and a half in circumference; at the ſmaller end, not above four tenths of an inch broad; it had neither ſhell, cruſt, ſcales, or bone, for its covering, but was ſoft, yet not flabby or fleſhy, as the μαλακια, or *Mollia*, but rather membranous. The back, or upper ſide was of a roundiſh ſhape, eſpecially towards the ſides, in the middle it was ſomewhat flattened, the belly was perfectly plain; along the middle of the back there ran a large ſtripe from one extremity to the other, about two tenths of an inch broad, towards the upper end, but ſtill narrower as it came towards the tail; this ſtripe was all

all covered with a ſhort ſoft ſort of down, not unlike in texture, colour and ſubſtance, to that which grows on the back of the leaf of *Tuſſilago* or colt's-foot; joining to the edge of this ſtripe there ran a liſt about two tenths of an inch broad, that covered both ſides of the animal, and part of his back; this liſt or verge was thickly ſhagged with a fine ſoft hair, that was very thick, and about a quarter of an inch long, of a moſt delicate changeable red and green colour, and of ſo ſparkling and vivid a luſtre, that nothing of this kind could ſhew more beautiful; amongſt this ſoft hair there was thickly interſperſed, without any order, a number of black, ſharp, hard prickles, about the length of the hair, and the thickneſs of a hog's briſtle, but much harder, and very ſharp at the points; the tail, or ſmaller end terminated in the back, with two triangular pellucid ſoft ſcales, that covered the orifice of the *Anus*. The larger end, tho' it had not any horns, eyes, ears, noſe or gills, yet becauſe it was oppoſite to the tail, and here had its mouth, may properly enough be called the head; the mouth was a very large aperture for the bulk of the animal, not placed at the end, but ſomewhat underneath, as forming part of the belly, and could not be ſeen when the back was turned uppermoſt; the belly was flat, and no ways protuberant, covered with a ſmooth naked ſkin, of a much lighter colour than the back, irregularly ſpotted, with little dark browniſh ſpots, ſome larger, ſome ſmaller; it was broader towards the head, and grew ſtill narrower towards the tail, where for above the ſpace of an inch, it was curiouſly pinched with little indentures, reſembling the ſmall joints in the tail of ſome inſects; theſe diviſions, or joints were ſtill ſhorter and cloſer to each other, the nigher they were to the extremity of the tail; cloſe to each corner of the mouth, and ſo along both ſides of the belly, there was a row of feet, in a cloſe continued ſeries down to the outmoſt tip of the tail; the largeſt were placed towards the mouth, and upper part of the body, where they were about $\frac{1}{4}$ of an inch long, but downwards they grew leſs and ſhorter, ſtill gradually diminiſhing, the nearer they approached the end of the tail; where they were ſo minute, that they were inſenſibly loſt, and not eaſily to be diſtinguiſhed by the eye; from within the body, thro' the middle of each foot there paſſed four, five or ſix of the ſame ſort of ſharp hard prickles, interſperſed amongſt the ſoft hair; theſe were larger or ſmaller, more or fewer in number, according to the ſize of the foot, and give it ſtrength and firmneſs inſtead of bones, and likewiſe their iſſuing out beyond the end of the foot, ſerves in lieu of toes or claws; joining to this

row

row of feet, towards the back, there was ranged along each side in a direct line, a series of small, thin, soft, flat fins, in such order, as that each foot exactly answered its corresponding fin, so that their number was precisely the same with that of the feet, and they observed the same proportion as to their size, still gradually diminishing the nearer they approached towards the tail; Dr. *Molyneux* distinctly counted 36 of these of a side, as he had done also of the feet; each fin was curiously fringed at the edge, with the same beautifully coloured hair, that covered the sides, and part of the back; by means of these fins it performs its progressive motion in the water as a fish, and by means of its feet it can creep along the bottom of the sea, as a reptile. Upon opening it, there appeared a thin membranous gullet, leading from the mouth to the stomach, about an inch long; from this was continued straight downwards the stomach, of a whitish colour, and of a tough thick texture, consisting of an outward and inward membrane, with a sort of interveening fleshy substance, resembling somewhat in make, tho' not in figure, the gizzard in some fowl; it was as large as the upper joint of a man's little finger; to this was annexed the intestine, of a very different colour and substance from the stomach; for it was reddish, soft and tender, and of a much smaller cavity; it was continued almost directly, or with little circumvolution to the *Anus*; the brains, heart, gills, liver, and parts for generation, if they have any, were hardly, if at all, to be distinguished; the muscular parts were very curious, large and distinct; one long continued stripe of red fleshy fibres, about the sixth part of an inch broad, ran directly along the middle of the back, from the head down to the tail; this fleshy stripe sent out from each side, like so many rays, thirty six several pair of smaller lateral muscles, which by the considerable interstice between them, could be easily distinguished from each other; forming so regular a figure all together, that they might very aptly be resembled to the spine, or back-bone of the *Passer marinus*, or common plaice-fish, when it is entire with all its ribs, or transverse processes issuing by pairs from both sides of each *Vertebra*, from the head down to the tail; in this manner every particular foot and fin were supplied with their correspondent muscles, to give them motion, either together or a-part, as the necessity and design of the animal required; and besides, considering this sort of muscular mechanism, with the tapering shape of the body, and likewise the position and use of the many prickles interspersed amongst the hairy shag, that covered the sides; it seems very evident, that besides its progressive motion, it had

had alſo the power, as moſt of the many-footed land reptiles, and ſome water-inſects have, of contracting its body in ſuch a manner, that bending its head inwards, it rolls the reſt of its body round it as a centre, making a figure like a rope coiled into a ſpire; and in this poſture, beſet almoſt quite round with ſharp prickles, ſtarting out directly forwards, it guards itſelf from violences that may annoy it. This animal may on many accounts be properly ranged with the *Scolopendræ Marinæ* deſcribed by *Rondeletius*; but it may be diſtinguiſhed from them, by calling it *Scolopendra Marina a capite latiori verſus caudam ſenſim gracileſcens, limbo pulcherrime hirſuto, ſpinuliſque crebris interſtincto e Mari Hibernico.*

aaaaa Fig. 2. Plate VI. the downy liſt that runs along the back; *bb* the two triangular ſcales that cover the *Anus*; *ccccccc* the verge of fine changeable green and red hair that covered the ſides, and part of the back; *ddddddd* the hard ſharp prickles interſperſed amongſt the hair; *eeeee* the ſkin of the belly; *ffff* ſeveral inciſures reſembling joints towards the tail; *ggggg* darker ſpots in the ſkin of the belly; *hhhhh* the feet of each ſide the belly; JJJJJJ the fins with their hairy fringe behind the feet; *kk* the large mouth opened wide.

The long Worm *in the* Fleſh *in the* Eaſt-Indies. Phil. Tranſ. N° 225. p. 417.

THESE long worms are bred in the water, between *Gomroon* and *Schiraz*, in the *Eaſt-Indies*, eſpecially that about *Laur*; they come out in any part of the body, ſometimes to the length of 6 or 7 yards, and are very troubleſome and dangerous, ſome loſing their legs and others their lives by them; at firſt, they are ſmall like a thread, afterwards they grow bigger and ſtronger by degrees. They roll them up on a little bit of ſtick, or cotton, and lay upon them onions and flower of rice boiled in milk; the principal thing to be obſerved is not to break them, for then it is they do miſchief, cauſing exceſſive pain and ſwelling.

The Internal Structure of Fiſh; *by Dr.* Charles Preſton. Phil. Tranſ. N° 225. p. 419.

FISH are remarkably different from all other animals in many particulars; the moſt conſiderable difference is their want of lungs and reſpiration; and yet it is neceſſary that ſomething ſhould ſupply this in fiſhes, which may have the ſame effect upon their blood, as the air has upon ours, by entring into

our

our lungs, that is to ſay, to divide and diſſolve it, and render it fit for circulation. Now we find no part in fiſh more proper to produce this effect than the *Bronchiæ*, that lie like ſo many leaves upon each other under their gills; for they receive the water in by the mouth, and return it by the gills, or receiving it in by the gills, they throw it out by the mouth; hence it is agreed upon by all, that the water contains ſomething that produces this effect, and this ſeems moſt probably to be air. That there is air in all water cannot be doubted after the experiment of M. *Marolle*; he ſet a veſſel of water over the fire, ſo as to drive out the air from it; this water he put into the air-pump to extract the air from it, and after that, filled a phial with it, within two or three fingers of the top, which ſpace he left only full of air, and ſtopped the phial well, and by ſhaking it, the water imbibed the air, ſo as to riſe up and quite fill the phial.

But we need not wonder that fiſh cannot alſo live in the open air; their blood is naturally leſs hot than ours, ſo that the natural heat of our blood would be a fever in them, and prove mortal; for the nitre of the pure air is in too great a quantity, and too ſubtile, ſo that it diſſolves their blood too much, and makes it too fluid, whereas the nitre in the water is more groſs and in leſſer proportion; whence it gives their blood only a fluidity requiſite to keep it in its natural ſtate. In order to prove that it is in the *Bronchiæ* that this diviſion is performed, we need but obſerve their extraordinary redneſs above any other parts of the body, a proof that the blood is comminuted therein; fiſh are alſo found to die in water frozen over, which happens plainly from their communication with the external air being hindred by the ice. The heart of a fiſh is different from that of other animals, in its having but one ventricle; for the only veſſels that open into it are the *Vena Cava*, and the *Aorta*, being without lungs; ſo that by the *Aorta* the blood comes out of the heart, which is branched into a thouſand capillaries over the *Bronchiæ*, and is after that reunited; which re-union is made under the baſis of the *Cranium*, and becauſe the blood, when once there, has no need of being forced higher upwards, they have no occaſion for a ſecond ventricle for that purpoſe, as terreſtrial animals have; the re-union of theſe capillaries of the *Bronchiæ* being made, they form two large trunks, of which one proceeds towards the head, and the other towards the lower parts. Fiſh have a diaphragm, but not for the ſame purpoſe, as in other animals that breathe; it is always ſtraight and tenſe, and perpendicular to the *Vertebræ*. Their ſtomach is membranous, for fiſh ſwallow down other ſmaller

ſmaller fiſh whole, and ſometimes earth; wherefore it is needful that it have a power of contracting and ſtraitning itſelf, forcibly to break to pieces its contents. Their inteſtines make ſeveral great windings, a ſign the fermentation is but ſlow therein, which is compenſated by the length of the inteſtines. The liver has much the ſame ſituation as in other animals, as alſo the ſpleen; they are provided of a gall-bladder, a *Ductus Choledochus*, and *Pancreas*, or rather two little bags faſtened to the ventricle for the ſame uſe; fiſh have uſually many *Pancreas*'s, ſo that in ſome there have been found forty four. They have kidneys, bladder, *&c.* They have the ovary near the *Vertebræ* of the loins; the eggs come out at a paſſage below the *Anus*, and the male has a like *Ductus*, or hole; by which they eject their ſeed upon that of the female to impregnate the eggs. Fiſh are furniſhed with a bladder on the loins, very large in proportion to their bulk, which ſerves, by compreſſing or dilating itſelf, to render the fiſh more or leſs heavy, as occaſion requires; the fins and tail aſſiſt themſelves in their paſſage thro' the water, but it is this dilatation that makes them capable of ſwimming therein, and if this bladder be by any means burſt, ſo that it cannot be extended, the fiſh can no longer raiſe themſelves in the water, but keep continually at the bottom. Flat fiſh, as ſoles, have no ſuch bladder; for they are able, by reaſon of their breadth, to ſuſtain themſelves in the water; cray-fiſh and other ſhell-fiſh want it likewiſe for the moſt part, they creeping only at the bottom of the water; and ſeveral fiſh have them double.

Mr. Newton's *Theory of the* Tides *explained by Mr.* Halley. Phil. Tranſ. N° 226. p. 445.

THE ſole principle, upon which Mr. *Newton* proceeds to explain moſt of the great and ſurpriſing appearances of nature, is no other than that of gravity, whereby on the earth all bodies have a tendency towards its centre; and there is the like gravitation towards the centre of the ſun, moon, and all the planets; from this principle, as a neceſſary conſequence, follows the ſpherical figure of the earth and ſea, and of all the other celeſtial bodies; and tho' the tenacity and firmneſs of the ſolid parts, ſupport the inequalities of the land above the level; yet the fluids, preſſing equally, and eaſily yielding to each other, ſoon reſtore the *Æquilibrium*, if diſturbed, and maintain the exact figure of the globe. Now this force of the deſcent of bodies towards the centre, is not in all places alike, but is ſtill leſs and leſs, as the diſtance from the centre encreaſes; and this force

decreaſes as the ſquare of the diſtance encreaſes, that is, the weight of bodies and the force of their fall is leſs, in parts more removed from the centre, in proportion to the ſquares of the diſtances; ſo as, for inſtance, a ton weight on the ſurface of the earth, if it were raiſed to the height of 4000 miles, which Mr. *Halley* ſuppoſes the ſemidiameter of the earth, would weigh but $\frac{1}{4}$ of a ton, or five hundred weight; if to 12000 miles or three ſemidiameters from the ſurface, that is four from the centre, it would weigh but $\frac{1}{16}$ part of the weight on the ſurface, or a hundred and a quarter; ſo that it would be as eaſy for the ſtrength of a man at that height to carry a ton weight, as here on the ſurface 100 $\frac{1}{4}$; and in the ſame proportion the velocities of the fall of bodies decreaſe; for whereas on the ſurface of the earth all bodies fall 16 foot in a ſecond, at one ſemidiameter above this ſurface, this fall is but four foot, and at three ſemidiameters, or at four from the centre, it is but $\frac{1}{16}$ of the fall at the ſurface, or but one foot in a ſecond; and at greater diſtances both weight and fall become very ſmall; yet at all given diſtances, it is ſtill ſomething, tho' the effect become inſenſible; at the diſtance of the moon, which we will ſuppoſe 60 ſemi-diameters of the earth, 3600 pounds weigh but one pound, and the fall of bodies is but $\frac{1}{3600}$ of a foot in a ſecond, or 16 foot in a minute; that is, a body ſo far off deſcends in a minute no more than the ſame at the ſurface of the earth would do in a ſecond of time; as was ſaid above, the ſame force, decreaſing after the ſame manner, is evidently found in the ſun, moon, and all the planets, but more eſpecially in the ſun, whoſe force is prodigious, becoming ſenſible even at the immenſe diſtance of ſaturn; this gives room to ſuſpect, that the force of gravity is in the celeſtial bodies proportional to the quantity of matter in each of them; and the ſun being at leaſt ten thouſand times as big as the earth, its gravitation, or attractive force, is found to be at leaſt ten thouſand times as much as that of the earth, acting on bodies at the ſame diſtance.

This law of the decreaſe of gravity being now made out beyond contradiction, Mr. *Newton* does, with great ſagacity, enquire into the neceſſary conſequences of this ſuppoſition; whereby he finds the genuine cauſe of the ſeveral appearances in the theory of the moon and planets, and diſcovers the hitherto unknown laws of the motion of comets, and of the ebbing and flowing of the ſea; and this latter Mr. *Halley* explains from Mr. *Newton*'s principles, in the following manner.

If

If the earth were alone, that is to ſay, not affected by the actions of the ſun and moon, it is not to be doubted, but the ocean, being equally preſſed by the force of gravity towards the centre, would continue in a perfect ſtagnation, always at the ſame height, without either ebbing or flowing; but it being here demonſtrated that the ſun and moon have a like principle of gravitation towards their centres, and that the earth is within the activity of their attractions, it will plainly follow, that the equality of the preſſure of gravity towards the centre will thereby be diſturbed; and tho' the ſmallneſs of theſe forces, in reſpect of the gravitation towards the centre of the earth, renders them altogether imperceptible by any experiments we can deviſe, yet the ocean being fluid and yielding to the leaſt force, by its riſing ſhews where it is leſs preſſed, and where it is more preſſed by its ſinking. Now if we ſuppoſe the force of the moon's attraction to decreaſe, as the ſquare of the diſtance from its centre encreaſes, as in the earth and other celeſtial bodies, we ſhall find, that where the moon is perpendicular either above or below the horizon, in the *Zenith* or *Nadir*, there the force of gravity is moſt of all diminiſhed, and conſequently the ocean muſt there neceſſarily ſwell by the coming in of the water from thoſe parts, where the preſſure is greateſt; *viz.* in thoſe places, where the moon is near the horizon. Thus, let M. Fig. 3. Plate VI. be the moon, E the earth, C its centre, and Z the place where the moon is in the *Zenith*, N where in the *Nadir:* Now by the hypotheſis it is evident, that the water in Z, being nearer, is more attracted by the moon than the centre of the earth C, and that again more than the water in N; wherefore, the water in Z hath a tendency towards the moon, contrary to that of gravity, being equal to the exceſs of the gravitation in Z, above that in C; and in the other caſe, the water in N, tending leſs towards the moon than the centre C, will be leſs preſſed, by as much as is the difference of the gravitations towards the moon in C and N. This being rightly underſtood, it plainly follows, that the ſea, which otherwiſe would be ſpherical, upon the preſſure of the moon, muſt form itſelf into a ſpheroidal or oval figure, whoſe longeſt diameter is where the moon is vertical, and ſhorteſt where ſhe is in the horizon; and that the moon ſhifting her poſition as ſhe turns round the earth once a day, this oval of water ſhifts with her, occaſioning thereby the two floods and ebbs obſervable in each 25 hours. And this may ſuffice as to the general cauſe of the tides: It remains now to ſhew how naturally this motion accounts for all the particulars that have been obſerved about them;

ſo that there can be no room left to doubt, but that this is the true cauſe thereof. The ſpring-tides upon the new and full moons, and neap-tides on the quarters, are occaſioned by the attractive force of the ſun in the new and the full conſpiring with the attraction of the moon, and producing a tide by their united forces; whereas in the quarters the ſun raiſes the water, where the moon depreſſes it, and on the contrary; ſo that the tides are made only by the difference of their attractions; that the force of the ſun is no greater in this caſe, proceeds from the very ſmall proportion the ſemi-diameter of the earth bears to the vaſt diſtance of the ſun. It is alſo obſerved, that, *cæteris paribus*, the equinoctial ſpring-tides in *March* and *Sept.* or near them, are the higheſt, and the neap-tides the loweſt; which proceeds from the greater agitation of the waters, when the fluid ſpheroid revolves about a greater circle of the earth, than when it turns about in a leſſer circle; it being plain, that if the moon were conſtituted in the pole, and ſtood there, that the ſpheroid would have a fixed poſition, and that it would be always high-water under the poles, and low-water every where under the equinoctial; and therefore the nearer the moon approaches the poles, the leſs is the agitation of the ocean, which is of all the greateſt, when the moon is in the equinoctial, or fartheſt diſtant from the poles; whence the ſun and moon, being either conjoined or oppoſite in the equinoctial, produce the greateſt ſpring-tides, and the ſubſequent neap-tides, being produced by the tropical moon in the quarters, are always the leaſt tides; whereas in *June* and *December* the ſpring-tides are made by the tropical ſun and moon, and therefore leſs vigorous, and the neap-tides by the equinoctial moon, which therefore are the ſtronger; hence it happens, that the difference between the ſpring and neap-tides in theſe months is much leſs conſiderable than in *March* and *September*. And the reaſon why the very higheſt ſpring tides are found to be rather before the vernal, and after the autumnal equinox, *viz.* in *February* and *October*, then preciſely upon them, is, becauſe the ſun is nearer the earth in the winter months, and ſo comes to have a greater effect in producing the tides.

Hitherto we have conſidered ſuch affections of the tides as are univerſal, without relation to particular caſes; what follows from the different latitudes of places will be eaſily underſtood by the figure. Let A *p* E P, Fig. 4. Plate VI. be the earth, covered over with very deep waters; C its centre; P *p* its *Poles*; A E the *Equinoctial*; F *f* the parallel of latitude of a place; D *d* another parallel at equal diſtance on the other ſide

ſide of the *Equinoctial*; H *h* the two points, where the moon is vertical; and let K *k* be the great circle, wherein the moon appears horizontal; it is evident, that a ſpheroid deſcribed upon H *h* and K *k* will nearly repreſent the figure of the ſea, and C *f*, C D, C F, C *d*, will be the heights of the ſea in the places *f*, D, F, *d*, in all which it is high-water; and ſeeing that in 12 hours time, by the diurnal rotation of the earth, the point F is transferred to *f*, and *d* to D, the height of the ſea C F will be that of the high-water, when the moon is preſent, and C *f* that of the other high-water, when the moon is under the earth; which in the caſe of this figure is leſs than the former C F; and in the oppoſite parallel D *d*, the contrary happens; the riſing of the water being always alternately greater and leſs in each place, when it is produced by the moon declining ſenſibly from the *Equinoctial*, that being the greateſt of the two high-waters in each diurnal revolution of the moon, wherein ſhe approaches neareſt either to the *Zenith* or *Nadir* of the place; whence it is, that the moon in the northern ſigns, in this part of the world, makes the greateſt tides when above the earth, and in the ſouthern ſigns, when under the earth; the effect being always the greateſt where the moon is fartheſt from the horizon, either above or below it; and this alternate increaſe and decreaſe of the tides has been obſerved to hold true on the coaſt of *England*, at *Briſtol* by Capt. *Sturmy*, and at *Plymouth* by Mr. *Colepreſs*. But the motions hitherto mentioned, are ſomewhat altered by the libration of the water, whereby, tho' the action of the luminaries ſhould ceaſe, the flux and reflux of the ſea would for ſome time continue; this conſervation of the impreſſed motion diminiſhes the differences that otherwiſe would be between the two ſubſequent tides, and is the reaſon why the higheſt ſpring-tides are not preciſely on the new and full-moons, nor the neaps on the quarters, but generally they are the third tides after them, and ſometimes later.

All theſe things would regularly happen, if the whole earth were covered with ſea to a great depth; but by reaſon of the ſhoalneſs of ſome places, and the narrowneſs of the ſtreights, by which the tides are in many caſes propagated, there ariſes a great diverſity in the effect, and not to be accounted for, without an exact knowledge of all the circumſtances of the places; as of the poſition of the land, and the breadth and depth of the channels by which the tide flows; for a very ſlow and imperceptible motion of the whole body of the water,

where

where it is, for inſtance, two miles deep, will ſuffice to raiſe its ſurface 10 or 12 foot in a tide's time; whereas, if the ſame quantity of water were to be conveyed upon a channel of 40 fathoms deep, it would require a very great ſtream to effect it in ſo large inlets, as are the channels of *England* and the *German* ocean; whence the tide is found to ſet ſtrongeſt in thoſe places where the ſea grows narroweſt, the ſame quantity of water being to paſs thro' a ſmaller paſſage; this is moſt evident in the *Streights* between *Portland* and *Cape le Hogue* in *Normandy*, where the tide runs like a ſluice, and would be yet more ſo between *Dover* and *Calais*, if the tide coming about the iſland from the north did not check it; and this force, being once impreſſed on the water, continues to carry it above the level of the ordinary height in the ocean, particularly where the water meets a direct obſtacle, as at St. *Malo*'s; and where it enters into a long channel, which running far into the land, grows very ſtraight at its extremity, as in the *Severn Sea*, at *Chepſtow* and *Briſtol*. From this ſhoalneſs of the ſea, and the intercurrent continents, it is, that in the open ocean the time of high-water is not at the moon's appulſe to the meridian, but always ſome hours after it, as it is obſerved on all the weſt coaſt of *Europe* and *Africa*, from *Ireland* to the cape of *Good-Hope*; in all which a S. W. moon makes high-water, and the ſame is reported to be on the weſt ſide of *America*; but it would be endleſs to recount all the particular ſolutions, which are eaſy corollaries of this hypotheſis; as why lakes, ſuch as the *Caſpian Sea*; and midland ſeas, ſuch as the *Mediterranean*, the *Black Sea*, and *Baltic*, have no ſenſible tides; for lakes, having no communication with the ocean, can neither increaſe or diminiſh their water, whereby to riſe and fall; and ſeas that communicate by ſuch narrow inlets, and are of ſo immenſe an extent, cannot in a few hours time receive or empty water ſufficient to raiſe or ſink their ſurface ſenſibly. Laſtly, to demonſtrate the excellency of this doctrine, the example of the tides in the port of *Tonquin* in *China*, which are ſo extraordinary, and different from all others hitherto heard of, may ſuffice; in this port there is but one flood and ebb in 24 hours, and twice in each month; *viz.* when the moon is near the *Equinoctial*, there is no tide at all, but the water is ſtagnant; but with the moon's declination there begins a tide, which is greateſt, when ſhe is in the tropical ſigns; only with this difference, that when the moon is to the northward of the *Equator*, it flows when ſhe is above the earth, and ebbs when

when she is under it, so as to make high-water at the moon's setting, and low-water at the moon's rising; but on the contrary, the moon, being to the southward, makes high-water at rising, and low-water at setting, it ebbing all the time she is above the horizon.

The cause of this odd appearance is proposed by Mr. *Newton* to be from the concurrence of two tides, the one propagated in six hours out of the great *South Sea* along the coast of *China*, the other, out of the *Indian Sea*, from between the islands in 12 hours, along the coast of *Malacca* and *Cambodia*; one of these tides, being produced in north-latitude, is, as has been said, greater, when the moon being to the north of the *Equator* is above the earth, and less when she is under the earth; the other of them, which is propagated from the *Indian Sea*, being raised in south-latitude, is greater, when the moon declining to the south, is above the earth, and less when she is under the earth; so that of these tides alternately greater and lesser, there comes always successively two of the greater and two of the lesser together every day; and the high-water falls always between the times of the arrival of the two greater floods, and the low-water between the arrival of the two lesser floods; and the moon coming to the *Equinoctial*, and the alternate floods becoming equal, the tide ceases, and the water stagnates; but when she has passed to the other side of the *Equator*, those floods, which in the former order were the least, now becoming the greatest, that which before was the time of high-water, now becomes that of low-water, and *é contra*; so that the whole appearance of these strange tides is naturally deduced from these principles, and is a great argument of the certainty of the whole theory.

A Child *born alive without a* Brain; *by Dr.* Ch. Preston. Phil. Transf. N° 226. p. 439.

ALL the external parts of this child were well proportioned, only that it wanted the *Cranium*, *Cerebrum*, and *Cerebellum*; the visage was a little deformed; it had eyes and ears like a monkey, and it was all over the body more hairy than ordinary; in lieu of the brain, there was nothing but a substance like congealed blood, covered with a membrane, and instead of the optic nerves there were only found some small ligaments.

M. *du Verney*, professor of anatomy in the royal garden at *Paris*, traced in this subject the 8th and 9th pairs of nerves and

and the intercoſtal; and having cut up the canal of the *Vertebræ*, he diſcovered the *Medulla Spinalis* all along the cavity, and traced all the vertebral nerves proceeding therefrom, as alſo the *Sciatic* nerve, which was conſiderable enough; it is true, the *Medulla Spinalis* was not here of that conſiſtence as in adult perſons, but one could with ſome pains obſerve all the four tunics, and the two ſubſtances, as in the brain; *viz.* the cortical or glandulous ſubſtance, and the fibrous or white ſubſtance; but with this difference, that the brown ſubſtance is exterior in the brain, but interior in the *Medulla Spinalis*; for it is, as it were, a third brain contained in the canal of the *Vertebræ*, which are deſigned for its defence; it has *Meninges*, *Sinus*'s, and cavities, which may paſs for ventricles, like the brain; but it appears to be more ſenſible and neceſſary to life than the brain itſelf; for if you take away the brain, or *Cerebellum* from an animal, yet the animal will live for ſome time after, but a wound or compreſſion of the *Medulla Spinalis* will cauſe ſudden death; this is confirmed by ſeveral anatomical experiments. 1. M. *du Verney* took away the brain and *Cerebellum* from a pigeon, and ſtuffed the *Cranium* with flax, notwithſtanding which, it lived ſome time, ſearched for its aliment, did the ordinary functions of life, and had the uſe of its ſenſes. 2. M. *Chirac*, profeſſor of anatomy at *Montpelier*, took away the brain from a dog, yet he lived for ſome time after, but when the *Cerebellum* was taken out, he died immediately; but he obſerved, that by blowing into the lungs, the animal lived an hour, altho' without the *Cerebellum*. 3. He took away from another dog half the *Cerebellum*, but he died immediately. 4. After he had taken away half the brain from a third dog, he continued to have the motion of all the parts, and could walk about; and even after he had taken away all the brain, he had ſtill ſenſe and reſpiration. 5. He ſeparated the *Medulla Oblongata* of a fourth dog from the *Medulla Spinalis*, by introducing a pair of ſciſſars between the firſt *Vertebra* and the *Os Occipitis*; the dog had died immediately, but by blowing into the lungs, the motion of the heart was continued, and the animal could move his body. 6. He took the *Cerebellum* from a fifth dog, but he lived 24 hours, and his heart beat regularly.

All theſe experiments ſhew, that an animal may live for ſome time, tho' imperfectly, without the brain, and even the *Cerebellum*; but there is no experiment, where they ever lived without them all; it is therefore probable, that the *Medulla Spi-*

Spinalis was not wanting in this ſubject, but that it ſupplied the defect both of the brain and *Cerebellum*, and that the animal ſpirits were ſeparated therein, and diſtributed for continuing the circulation of the blood; for it is to be conſidered, that altho' the intercoſtal nerve and eighth pair have their origin in the *Medulla oblongata*, yet after they enter into the cavity of the breaſt, they are united with branches from almoſt all the vertebral nerves, and together with them make up ſeveral plexus's, and from thoſe plexus's ſeveral branches are emitted to the heart, and other parts, ſufficient for continuing the circulation of the blood; and this has occaſioned ſome to fall into a miſtake, thinking the circulation might be explained ſome other way, than by the influx of the animal ſpirits into the nerves, which they endeavour to prove by an experiment on a dog, by tying up the intercoſtal and eighth pair of nerves, before they enter the cavity of the breaſt, and yet the dog ſhall live for two or three days after; but except they can tie up all the vertebral nerves, or at leaſt tie up the nerves at their entrance into the heart, the experiment is not ſo convincing; and the ſymptoms, which ordinarily happen, even upon tying the intercoſtal and eighth pair, is an evident proof of the contrary, for the animal is immediately taken with convulſions.

Horns *of* American Deer *found under Ground in* Ireland; *by Dr.* Tho. Molyneux. Phil. Tranſ. N° 227. p. 489.

A Complete head of a deer, with both its horns entirely perfect, was dug up in *Ireland*; the dimenſions of this head were as follows, from the extreme tip of the right horn to that of the left A B, Fig. 5. Plate VI. was 10 foot 10 inches; from the tip of the right horn to the root, where it was faſtened to the head C D, 5 foot 2 inches; from the tip of the higheſt branch (meaſuring one of the horns tranſverſely, or directly a-croſs the palm) to the tip of the loweſt branch G F, 3 foot 7 $\frac{1}{2}$ inches; the length of one of the palms, within the branches G H, 2 foot 6 inches; the breadth of the ſame palm, ſtill within the branches I K, 1 foot 10 $\frac{1}{2}$ inches; the branches that ſhot forth round the edge of each palm, were one in number, beſides the brow-antlers, of which the right antler D L was 1 foot 2 inches in length, the other was much ſhorter; the beam of each horn M, at ſome diſtance from the head, was about 8 inches in circumference; at the root, where it was faſtened to the head, about 11 inches in circumference; the

length of the head from the back of the ſcull to the tip of the noſe, or rather the extremity of the upper jaw-bone N O, 2 foot; the breadth of the ſkull where largeſt, P Q, was a foot; there were two holes, near the roots of the horns, that looked like eyes, but were in reality large open paſſages, near an inch in diameter, in the bone of the forehead, to give way to great blood-veſſels, that here iſſue out of the head, and paſs between the ſurface of the horn, and the ſmooth hairy ſkin that covers them, whilſt they are growing, commonly called the velvet, to ſupply the horns with ſufficient nouriſhment, whilſt they are ſoft, and till they arrive at their full magnitude, ſo as to become perfectly hard and ſolid; theſe veſſels, by reaſon of their largeneſs and turgency, whilſt the horn is ſprouting and pliant, make deep and conſpicuous furrows all along the outſide of it, where they paſs, which may be plainly ſeen, after the horn is bare, and come to its full growth, at which time all theſe veins and arteries, with the external velvet ſkin ſhrivel up and ſeparate from the horn, and the animal affects to tear them off in great ſtripes againſt the boughs of trees.

It is not to be queſtioned, but theſe large horns, like others of the deer-kind, were naturally caſt every year, and grew again to their full ſize in about the ſpace of four months; for all ſpecies of deer, yet known, do certainly drop their horns yearly, probably owing to the ſame cauſe, that trees annually caſt their ripe fruit, or drop their withering leaves in autumn; that is, becauſe the nouriſhing juice is ſtopped, and flows no longer, either on the account, that it is now deficient, being all ſpent, or that the hollow paſſages, which convey it, dry up; ſo as the part having no longer any communication therewith, muſt of neceſſity, by degrees, ſever from the whole, but with this difference, that horns, by reaſon of their hard and ſtrong compoſition, ſtick faſt to the head by their root ſeven or eight months, after all their nouriſhment is perfectly ſpent; whereas leaves and fruit, conſiſting of a much more tender ſubſtance, and a finer texture of parts, drop ſooner, when once the ſupply of uſual nouriſhment is obſtructed; this analogy, obſerved by nature, in the caſting the horns of beaſts, and the dropping the fruits of trees, will appear much more evident to any one that will obſerve the end of a ſtalk, from which a ripe orange, or any large fruit, has been lately ſevered, and the but-end of a caſt horn, where it is faſtened to the *Os Frontis*; for by comparing them together, we ſhall find ſo great a congruity in the ſhape of both, that it will be apparent, nature works according to the ſame mechaniſm in one as in the other.

Several

Several of these heads were found in several parts of *Ireland*, an argument that this animal was formerly common in *Ireland*, and an indigenous animal, not peculiar to any territory, or province, but universally met with in all parts of the kingdom; we may also reasonably gather, that they were a gregarious animal, or such as affect keeping together in herds, several heads being found within a small compass of each other.

That these heads should be constantly found buried in a sort of marle, seems to intimate, as if marle was only a soil that had been formerly the external surface of the earth, but in process of time, being covered by degrees with many layers of adventitious earth, has, by lying under ground, a certain number of ages, acquired a peculiar texture, consistence, richness or maturity, that denominates it marle; for we must necessarily allow the place, where these heads are now found, was certainly once the external surface of the earth, otherwise it is hardly possible to suppose how they should come there. And that they should be so deep buried, appears to have happened by their accidentally falling where it was soft low ground; so that the horns, by their own gravity, might easily make a bed, where they settled in the yielding earth, and in a very long course of time, the higher lands being by degrees dissolved by repeated rains, and washed and brought down by floods, covered the lower ground with many layers of earth; for all high grounds, and hills, unless they consist of a rock, by this means naturally lose a little every year of their height, and sometimes become sensibly lower even in one age. How this species of animals, formerly so common and numerous in this country, should now become utterly lost and extinct, deserves our consideration. Some have been apt to imagine, that they were destroyed by the general deluge in *Noah*'s days; but it is not probable, that such a slight and porous substance as these horns, could be preserved entire from the time of that flood; and therefore it is more likely, that this animal might be destroyed here by some epidemic distemper, or pestilential murrain.

It remains that we enquire, what species of animals it was, to which these stately horns belonged; it is an opinion generally received, that they belonged to the *Alche*, *Elche*, or *Elende*, and therefore they are vulgarly called *Elche*'s horns; but they differ extremely from them, both in figure and size; and the description of that majestic horned animal in the *West-Indies*, called a *Moose*, much better agrees therewith, than that of the *Elche*, as having the same sort of palmed horns, of the same size and largeness, as well as figure, and the bulk of their bodies corresponding exactly

in proportion to the wide ſpreading of their horns; ſo that we may ſafely conclude, that *Mooſes* were formerly as frequent in *Ireland*, as they are ſtill in the northern parts of the *Weſt-Indies*, *New-England*, *Virginia*, *Maryland*, and *Canada*.

There are ſeveral things in which *Ireland* and the *Weſt-Indies* do partake in common; for as on the coaſt of *New-England*, and the iſland *Bermudas* conſiderable quantities of ambergreaſe are gathered, ſo on the weſtern coaſt of *Ireland*, along the counties of *Sligo*, *Mayo*, *Kerry*, and the iſles of *Arran*, they frequently meet with large parcels of that precious ſubſtance, ſo highly valued for its perfume; near *Sligo* there was found one piece, that weighed 52 ounces; on the outſide it was of a cloſe compact ſubſtance, blackiſh and ſhining, like pitch; but when it was cut, the inſide was more porous, and ſomething of a yellowiſh colour, not ſo grey, cloſe, and ſmooth as the cleaneſt and beſt ſort of amber, but like it, ſpeckled with whitiſh grains, and of a moſt fragrant ſcent. Nor is that ſpecies of whales, that are often taken in *New-England*, and which yield the true *Sperma Ceti*, a ſtranger to that coaſt of *Ireland*, that regards *America*, and which we may call the *Cetus dentatus*, from its large, ſolid, white teeth, fixed only in the lower jaw, to diſtinguiſh it from that ſpecies, which yields the whale-bone, juſtly denominated *Myſticetus* by *Ariſtotle*, from its bearded, horny *Laminæ* in the roof of the mouth. What ſort of ſubſtance *Sperma Ceti* is, and in what part of the whale it is found, naturaliſts and phyſicians are not agreed in; but Dr. *Molyneux* found it to be nothing other than part of the oil, or liquid fat of this particular ſort of whale; which oil, at firſt, when confuſed and mixed, ſhews like a whitiſh liquor, of the conſiſtence and colour of whey; but laid by in veſſels to ſettle, its parts by degrees ſeparate that which is lighter, and ſwiming a-top, becomes a clear oil, pellucid like water, anſwering all the uſes of common train-oil, which is got out of the blubber of other whales; that which ſubſides, becauſe it is heavier and of a cloſer conſiſtence, candies together at the bottom, and is what is ſold for *Sperma Ceti*, the blanching and refining of which is troubleſome, and requires no ſmall art, time, and charge; the fat of the whole body affords it, but that of the head yields the greateſt quantity, and pureſt *Sperma Ceti*.

Foſſile-

Foſſile-wood *near* York; *by Dr.* Richardſon. Phil. Tranſ. N° 228. p. 526.

AT *Youle* about 12 miles below *York*, near the place, where the *Dun* empties itſelf into the *Humber*, there are ſeveral perſons called *Tryers*, who, with a long piece of iron, ſearch in the ſoft and boggy ground for ſubterraneous trees; and by this way of trial, they can in a great meaſure diſcover the length and thickneſs of theſe trees, and they get a livelihood by it. Some are ſo large that they are uſed for timber in building houſes, which is ſaid to be more durable than oak itſelf, others are ſplit into laths, others are cut into long chips, and tied up in bundles, and ſent to the market towns ſeveral miles off, to light tobacco. The bate or texture of this wood is the ſame with fir, ſplitting eaſily; if burnt it emits the ſame reſinous ſmell, and it affords the ſame coal; the branches generally grow in circles, as appears by the knots, which eaſily ſeparate from the reſt of the wood, as is uſual in fir-wood; the ſtraitneſs and length of theſe trees are alſo a preſumption, that they muſt be ſuch; there are alſo oaks found there, tho' not in ſo great quantity. The vitriolic parts of the earth, in which they have lain, hath given them a black tincture quite thro', which, when wrought and poliſhed fine, is not much inferior to ebony; this does not emit the ſame ſmell when burnt, with that called fir-wood.

An Infant *with the Brain depreſſed into the hollow of the Vertebræ of the* Neck; *by Dr.* Edw. Tyſon. Phil. Tranſ. N° 228. p. 533.

THIS child was alive, but died in the birth, or a little before; it was well grown, all the limbs and body were well proportioned, and plump, the face, from the eye-brows only was well featured; the ſkull was entirely depreſſed down to the *Os ſphenoides*, ſo that it had no forehead at all. Dr. *Tyſon* opened the *Cranium* in ſeveral places, before he could find any brains at all; but at length he obſerved, near the paſſing out of the *Medulla oblongata* to the *Medulla ſpinalis*, a ſmall quantity of the brain, the whole might be included in a walnut, it was covered over with a bloody matter; but upon thruſting down his little finger thro' the *Foramen* where the *Medulla ſpinalis*, paſſes, he obſerved a very large cavity in the hollow of the *Vertebræ* of the neck; this large cavity was filled with a ſubſtance like the brain or *Medulla ſpinalis* or both, but far larger than the *Medulla ſpinalis* itſelf could be in ſo ſmall an infant. This made him

him eaſily conclude, that the brain muſt be preſſed down thither, which he was the more induced to believe, becauſe the mother told him, that when ſhe was with child, ſhe received a conſiderable bruiſe in the belly.

How far the *Medulla ſpinalis* may anſwer the office of the brain, eſpecially in embryos, where there is no exerciſe of the ſenſes, nor of the imaginative faculty, will be no great difficulty to apprehend; ſince the ſpirits generated even in the *Medulla ſpinalis* may ſuffice for all the functions of life in them; eſpecially in this inſtance, where a great part of the brain is ſuppoſed to be detruded into the cavity of the *Vertebræ*; and it may be queried, whether in thoſe inſtances, that are given of births of infants without brains, there might not be a like depreſſion thereof or of its principal parts into the *Vertebræ*, which in embryos are parts capable of extenſion.

An Optic Lens *of Water, and a reflecting* Microſcope; *by Mr.* Stephen Gray. Phil. Tranſ. N° 228. p. 539.

DROPS of fair water, being let fall on a piece of plain glaſs, form themſelves into plano-convexes, having a convexity proportional to the heights from which they deſcend; *viz.* from a greater height a leſs, and from a leſs a greater degree of convexity. Mr. *Gray* applied ſome of theſe as reading-glaſſes for ſingle words of ſmall letters, as on globes and maps, and he found no other inconveniency, than that the fluidity of the water obliges one to keep the glaſs horizontal; to remedy which, he took a ſufficient quantity of iſing-glaſs, and diſſolved it in water over the fire, and whilſt it was warm, he dipt a ſtick into the ſolution, and let ſome drops of it fall on the glaſs as before, and in a quarter of an hour they acquired a conſiſtency, that ſuffered them to be held in any poſition; and tho' they were not altogether ſo tranſparent, yet this was little or no impediment to their uſe. The drops of this ſolution are more accurately defined than thoſe of common-water, having their edges exactly circular, and they may be made of a much longer *Focus*.

A thin flat ring of braſs, not exceeding $\frac{1}{10}$ of an inch diameter in its interior circle, being cemented to a plain piece of glaſs, and filled with water, or the ſolution now mentioned, then preſſing with the finger into it, till what is ſuperfluous be taken off, there will be formed a plano-concave, which may ſerve as an eye-glaſs to a proſpective, or to any other optical uſe, concave glaſſes are applicable to.

Mr. *Gray*

Mr. *Gray* tried what would be the ſucceſs of combining portions of water by the help of braſs rings, and plain pieces of glaſs, to give them their true figure and requiſite apertures, and he inſerted them at the ends of tubes of ſeveral lengths, and he found that tho' theſe natural lenſes may ſerve as eye-glaſſes, yet when uſed as object-glaſſes, either to teleſcopes, or double microſcopes, the effects will not compenſate the trouble there is in uſing them.

A Fig. 6. Plate VI. repreſents a ſmall flat ring of braſs, whoſe interior circle muſt not much exceed $\frac{1}{10}$ of an inch diameter, and be about $\frac{1}{20}$ of an inch thick; this we may call the frame or cell of the glaſs; it muſt be prepared for uſe in the following manner. Take a ſmall globule of quickſilver, and diſſolve it in a few drops of *Aqua-fortis*, to which you may add 10 parts of common water; dip the end of a ſtick in this liquor, and rub the inward circle of the ring therewith, ſo as to acquire a mercurial tincture, and being wiped dry, be fit for uſe; then let it be laid on the table, and pour a drop of quickſilver within it, which preſs gently with the ball of the finger, and it will adhere to the ring, then cleanſe it with a hare's foot, and you will have a convex *Speculum*; take up the ring and *Speculum*, carrying it horizontally, and lay it on the brims of the hollow cylinder B; and thus the mercury will become a concave reflecting *Speculum*, which, from the ſmallneſs of the ſphere, of which it ſeems to be a ſection, may be uſed as a microſcope; the cylindrical veſſel B has a ſcrew-hole at the bottom, by which it is ſcrewed to the top of the pedeſtal CD; CEFG is the ſupporter of the object-plate, which may be either raiſed higher, or let down lower, as there is occaſion, by the ſcrew on the pedeſtal; the object plate muſt be of glaſs cemented to the ring G.

This inſtrument, with a little variation, may be made a microſcope of water, if, inſtead of the ring G, there be only a ſmall arm with a hole in it to receive a drop of water, and the cylindrical veſſel B be either taken away, or ſcrewed on with its bottom upwards, ſo as to make an object plate. This will be more convenient for viewing the texture of opaque objects, than that above deſcribed, which is fitter for fluid and tranſparent ones.

A red Colour *produced by a ſulphureous* Spirit *and a volatile* Alcali. Phil. Tranſ. N° 228. p. 542.

THIS ſulphureous ſpirit is made by diſtilling two or three pounds of benzoin with a little ſand in a retort, *ad Siccitatem*, and putting the oil, ſpirit and flowers all together into a paper

paper filtre, the ſpirit comes firſt thro'. You may put two parts of this ſpirit to one of ſpirit of ſal armoniac, or urine, *&c.* and ſhaking the glaſs or bottle, it will become red in a moment, tho' both the liquors were clear before, and the more the glaſs is ſhaken, the deeper will the red be; it produces this effect without any effervescence; this experiment may perhaps be uſeful in explaining ſanguification.

A Blackiſh Stone *in* Shropſhire *yielding* Pitch, Tar *and* Oil; *by Mr.* Martin Ele. Phil. Tranſ. N° 228. p. 544.

IN *Broſely*, *Bentley*, *Pitchford*, and other adjacent places in *Shropſhire*, there lies over moſt of the coal-pits, or mines, a *Stratum* or layer of a blackiſh rock, or ſtone, of ſome thickneſs, which is porous, and contains in it great quantities of bituminous matter. This ſtone, being brought to the work-houſe, is ground ſmall by horſe-mills, ſuch as are uſed for grinding flints to make glaſs of; the powder is thrown into great coppers of water, where, by boiling, the bituminous matter is ſeparated from the ſtony or gritty part, this laſt ſinking to the bottom, the other ſwimming at the top of the water. This bituminous ſubſtance being gathered together, and evaporated, becomes of the conſiſtence of pitch, and this, by means of an oil, diſtilled from the ſame ſtone, and mixed therewith, becomes thinner, or like tar. Theſe ſubſtances are found to exceed common pitch and tar, in that they do not crack, but keep always black and ſoft, by which they may be ſerviceable to prevent the worms from hurting ſhips pitched therewith. The oil may be uſed for oil of petre or turpentine, and it has been tried in aches or pains.

The Diſſection of a Scallop; *by Dr.* Liſter. Phil. Tranſ. N° 222. p. 567. *Tranſlated from the* Latin.

IN the firſt place Dr. *Liſter* obſerved the *Cardo*, or hinge of the concave ſhell to be gently bent and laid on the other of the plain ſhell, both which were firmly connected together by a cartilage; alſo in the very middle of the hinge there was another very black and ſtrong cartilage; hence ariſes that wonderful conſtrictive force it is endued with, and perhaps the power of moving the plain ſhell, like an oar, to row by; which the ancients have often mentioned as peculiar to this ſhell-fiſh. Upon opening the ſhells, he obſerved the following particulars; to the right hand and under the hinge a cowled mouth like an oyſter; this cowl is made up by the concourſe of the external *Branchiæ* or gills, which are muſcular, and encompaſs the animal entirely from the head

head to the extremity of the *Anus*, *viz.* towards the left hand oppoſite to the mouth, where they are again connected together. One of the exterior *Branchiæ*, which lies upon the plain ſhell, adheres by its centre to the ſuperior border of that large round muſcle, which at right angles is inſerted into the middle of the ſhells; the other exterior *Branchiæ* is in like manner connected with the other head of the ſame central muſcle; from the central muſcle theſe two exterior or ſpurious *Branchiæ* conſiſt of a very thin and pellucid membrane, and expanded to the middle of the ſhells; they ſlightly adhere to them, ſo as to become immoveable, and defend the back of the animal from being injured by the water taken into the ſhells; from this place of adheſion an extraordinary and thick muſcle, like a border ariſes, which, when the animal is alive is capable of great extenſion, even far beyond the brims of the ſhells; it is alſo furniſhed with fringes, and from a reddiſh colour it is variegated with very elegant ſtreaks; the uſe of this border ſeems to be this; *viz.* by its contraction inwards, like a net, when both theſe branchiated muſcles are darted out of the ſhell, whatever prey they lay hold on, upon their cloſing together, is for the food of the animal; and the ſea-water ſeems to be ſeparated by the fringes, which are indented in their extremities whilſt the food remains behind. This border may alſo ſerve for killing any ſmall prey by its ſtrong compreſſion; and by its undulatory motion, which is very remarkable, it may both retain the food, and convey it from any part of the circular net into the mouth, and in this manner perform the office of a hand. To come now to the true *Branchiæ*, at leaſt ſuch as are ſo called; theſe are four in number, of a light yellow, and ſtriated in an elegant manner, they encompaſs the large central muſcle, and contain between them or lie upon the *Uterus*, and its ovary, at leaſt on the parts deſigned for generation. Near the mouth is a proceſs with a double aperture, one of which is the outlet of the *Vulva*, and the other, if they are hermaphrodites, as is very probable, is deſigned for the exertion of the *Peris*. To proceed to the head, its mouth is furniſhed with reddiſh and very ſhort lips, like the internal *Branchiæ*; about the middle of the hinge are two large circles or cavities, like the eyes of a turbot, placed obliquely. Next the mouth and head to the left is a large blackiſh *Meconium*, behind that lies the heart, which may be ſeen thro' its tranſparent *Pericardium*, it is between a fleſh colour and a reddiſh; the *Aorta* is diſtributed into the *Branchiæ*; from the *Meconium* ariſes the *Rectum*, and paſſing over the *Pericardium*, it reaches to the

internal *Branchiæ*, and is fastened to the central muscles. The central muscle is of an orbicular form, white and smooth for a great part of its surface, where it adheres to the shell; on the left side it is furnished with another whiter and lacerated muscle, and more firmly fastened to the shell.

aaa Fig. 1. Plate VII. the mouth and head; *bb* the black *Meconium*; *c* the heart; *dd* either the *Pericardium*, or bladder of urine; *eeeee* the *Rectum* riding over the *Pericardium*; *fffff* the great central muscle; *gg* another lacerated muscle adhering strongly to the shell; *hhhh* the internal *Branchiæ*; *ii* the extremity of the extended *Uterus*, furnished with two apertures, as in hermaphrodites; *kk* the superior whitish part of the *Uterus*; *lll* the inferior yellowish part of the *Uterus*; *mmmmm* the variegated border, or the *Musculus retiarius secundus*.

A Storm of Hail *in* Hertfordshire; *by Mr.* Rob. Taylor. Phil. Transf. N° 229. p. 577.

ON *Tuesday May* 4th, 1697 at *Hitchin* in *Hertfordshire*, about 9 o'clock in the morning, it began to lighten and thunder very much, with some great showers between; it continued till about two o'clock in the afternoon, when on a sudden, a black cloud arose south-west, the wind being east and blowing hard; then there fell a sharp shower with some hail-stones, some of which measured 7 and 8 inches about; but the extremity of the storm fell about *Offley*, where a young man was killed, one of his eyes stuck out of his head, and his body was all over black with the bruises; another man nearer to *Offley* escaped with his life, but was much bruised. The hail fell in such vast quantities, and so large, that it tore up the ground, split great oaks and other trees; it cut down great fields of rye, as if it had been done with a scythe, and destroyed several hundred acres of wheat, barley, *&c.* there fell some hundred thousand cart-loads; they measured from one to 13 and 14 inches; their figures were various, some oval, others round, others tapering, some flat.

The Height of the Mercury *at the top of* Snowdon Hill; *by Mr.* Edm. Halley. Phil. Transf. N° 229. p. 582.

MAY 26, 1697, between one and two in the afternoon, on the top of *Snowdon-hill* Mr. *Halley* repeated thrice the *Torricellian* experiment, and as often found the height of the mercury, 26, 1 inches; and being come down to *Llanberris*, at the foot of the hill, about 6 that evening, he found the mercury by a triple experiment, to stand at 29, 9 inches, very near the surface

ſurface of the ſea; when at the ſame time, at *Llanerch*, in *Denbyſhire*, about 25 miles eaſt of *Snowdon*, and ſix from the ſea, ſeveral foot above the ſurface thereof, by Mr. *Davis*'s ſtanding barometer, it was about 29, 7½ inches; and the air continued, both before and after, in the ſame ſtate. Hence Mr. *Halley* concludes, that the difference of the preſſure of the air on the ſea, and on the top of *Snowdon*, is rather more than 3 inches 8 tenths. *Snowdon* was meaſured by Mr. *Caſwel*, and he found its height 1240 yards; which, abating the height of the mercury, 3 inches 8 tenths, may ſerve for a ſtandard, till a better be obtained on a higher place.

A Voyage *from* England *to* Conſtantinople; *by Dr.* Tho. Smith. Phil. Tranſ. N° 230. p. 597.

AUG. 3d, 1668, we went on board the *Bezant Yacht* for the *Downs*, where we arrived the next day in the afternoon, and went on board the *Leopard Frigate*, Capt. *O Bryan* commander, appointed to carry Sir *Daniel Harvey*, His Majeſty's ambaſſador, to the port of the *Ottoman* emperor at *Conſtantinople*. *Aug.* 9th, we ſailed from the *Downs*, but were forced to anchor S. W. off the ſouth *Foreland*; we carried a flag upon our main-top, after we come out of the *Downs*. *Aug.* 17th, in the morning we got to the weſt of *Portland*; but about noon, ſailing over part of the race of *Portland*, where we met with a tumbling ſea, we anchored at the N. W. part of the bay, over-againſt the point that looks towards *Weymouth*; we went a-ſhore on the iſland, which ſeems to be but one continued rock, the ſoil in ſeveral places not being above 5 or 6 inches deep, yet the corn flouriſhing enough; the caſtle conſiſts of a double fortification, we did not obſerve above 3 guns mounted; there is only one church and 4 villages in the whole iſland. *Aug.* 29th, we got into *Plymouth* ſound; the citadel is built upon a rock, with large counterſcarps and baſtions. *Aug.* 20th, we weighed out of *Plymouth* ſound, and made the *Lizard*, a promontory in *Cornwal*; the *Manacles*, ſeveral rocks ſo called, were very diſtinctly ſeen, it being then low-water, as alſo the *Land's End*; the wind blew freſh, and we obſerved the waves in the night-time, as if they had been liquid fire, but paliſh. *Aug.* 25th, we were full open with the bay of *Biſcay*; ſeveral ſea-gulls were ſeen hovering over the ſurface of the water, to catch fiſh which ſwam by in vaſt ſhoals, at above 50 leagues diſtance from any land; at other times we ſaw ſeveral birds floating on the water, which, being driven by ſome tempeſt from the coaſts of *Spain* and *Portugal*,

had been tired in their flight, and ſo drowned; this happens frequently in the great ocean, where they meet with no land for ſeveral hundred leagues. *Aug.* 30, in the afternoon, we weathered the weſtermoſt iſle of the *Burlings*, on the greateſt of which, the *Portugueze* have built a fort, to hinder the *Barbary* pyrates from careening their ſhips there, or taking in freſh water; for two nights together, the ſky being very hazy, the ſun ſet in with a colour as deep as blood, which was very aſtoniſhing. *Sept.* 1, in the morning, we made cape St. *Vincent*; all along the coaſts, at the diſtance of about two or three leagues, are ſeveral watch-towers built, to give notice of pyrates. *Sept.* 5, in the morning, we weathered the point of *Cadiz*, and came to an anchor in the bay of *Bulls*, about half a league from the great *Porgos*, and in the afternoon we went aſhore, where we were entertained by the *Engliſh* conſul, and carried by him to view the fortifications, which are eſteemed to be as regular as any in Chriſtendom, and built in the ſame place where the town had been attacked formerly by the *Engliſh*, under the conduct of the earl of *Eſſex*, in the reign of queen *Elizabeth*. *Sept.* 11, we came to an anchor in *Tangier* bay. *Tangier* lies within the entrance into the *Streights*, in the Lat. of 35° 36'; it is ſituated in the bottom of a bay, and built on the ſide of a hill, overlooking the ſea, encompaſſed with high walls towards the land, and commanded by a ſtrong caſtle; the heat would be very troubleſome here, but for the ſea-breezes, which cool and fan the air. In the caſtle, Dr. *Smith* met with a *Roman* monument, erected to the honour of *P. Beſius*, a great officer and ſoldier in *Trajan*'s time, who, amongſt his other titles, is there ſtiled, PRO. FIG. MAURITANIAE TINGITANA, (which ſince has been taken away, and preſented to the univerſity of *Oxford* by Sir *Hugh Cholmondley*.) The *Engliſh* have two churches here, both of them very neat and convenient, tho' not to be compared with the church of the *Portugueze*, retained ſtill (according to the articles of agreement, when the king of *Portugal* made over the right, and gave the poſſeſſion of *Tangier* to the crown of *England*) by canons regular; this church is very ſtately, adorned with rich images, and ſupported by marble pillars. Towards ore end of the *Engliſh* church, juſt by the veſtiary, which had been formerly a *Turkiſh* moſque, and afterwards the chapel of a convent of Dominicans is a monumental ſtone-table, with *Arabic* characters, containing an account of the houſes, lands, and other revenues belonging thereto, ſet up in the 743d year of the *Hegira*, that is of Chriſt 1341. The mole is

in

in good forwardneſs, having gained above 200 yards of the ſea, in order to the making a good and ſafe harbour for ſhips to ride in. *Old Tangier* lies at ſome ſmall diſtance, and there they find very frequently in digging, ſeveral pieces of *Roman* coin. *Sept.* 13, we weighed out of *Tangier*, and turned into the *Streights*; the diſtance between *Gibraltar* (which gives name to the *Streights*, and which is joined to the continent of *Spain* by a narrow iſthmus) and *Ceuta*, a well built and ſtrongly fortified town, lying under the hill *Alybe*, ſo called by the *Greeks*, and by ſeamen commonly *Apes-hill*, from the number of apes that uſed formerly to haunt there, may be about ſix leagues, tho' both lands lying very high (for we ſaw the clouds much below them) it does not appear in the middle of the current, from a tall ſhip, ſcarcely half ſo broad; it is at theſe places, *Hercules* is feigned to have ſet up his pillars. *Sept.* 15, there was a great miſt all over the ſea, ſo that we could ſcarcely ſee three lengths of the ſhip, but it began to vaniſh in the afternoon, and then we deſcried the cape of *Malaga*, at about four leagues diſtance; this city lies under a high hill, and is the ſeat of a biſhop. *Sept.* 16, the next morning we weighed from *Malaga* road, the weather very hot; in the evening the ſea being calm, we ſaw a great number of tortoiſes ſwimming above water, ſeveral bottle-noſes, a fiſh of about three yards in length, and very thick, and hawks flying over to the *Barbary* coaſt; the hills of *Granada* were plainly ſeen, tho' at a great diſtance. *Sept.* 25, between 3 and 4 o'clock in the morning, the tornado's began to blow, and the wind was violent for the time, with ſuch continued flaſhes of lightning for ſeveral hours, as that the whole ſky ſeemed to be on fire, intermixed with dreadful claps of thunder, after which there were great ſhowers of rain. *Sept.* 29, at noon we made the iſland of *Majorca*, ſituated over-againſt the kingdom of *Valentia*; we landed within the *Mole*; the walk upon it is about four or five yards broad, at the extremity of which is a very large and ſtately gate, which leads into the city; we went into the great church, which is ſomewhat wider than *Weſtminſter Abbey*, but darkiſh within; the portal is very magnificent, adorned with ſeveral marble ſtatues in niches, one over another; the high altar was very plain, and unadorned; but there were others extraordinary rich and glorious; not far from the city are ſeveral mills to grind their olives, oil being the great commodity of the iſland. *Oct.* 2, next morning we weighed anchor, and ſailed all along in ſight of the iſland, which preſented

ſented us with a pleaſant and delightful proſpect; the vallies, lying under the hills, abounded in wine and corn; the whole iſland is ſuppoſed to be about 60 leagues in compaſs, and in length about 15. To the S. S. E. lie ſeveral ſmall iſlands, called the *Cabreras*, between which and *Majorca* we ſteered. *Oct.* 4, we were athwart *Port-Mahon* in *Minorca*, a fine level country, having but one hill therein. *Oct.* 9, we were over-againſt the weſtermoſt part of the *Alps*, which we diſtinctly ſaw at about 20 leagues diſtance, and they appeared much higher than the hills of *Granada*. *Oct.* 12, we came in the morning to an anchor over-againſt the *Mole*, and not far from the *Lantern* in *Genoa*; *Genoa* is ſemicircular, beginning from the *Lantern* weſtwards, it lies under an high hill, upon the riſing of which, the ſeveral houſes, built of marble, afford a very fine proſpect, and add much to the beauty and glory of the place; *Strada Nuova* is perhaps the moſt ſtately ſtreet in the whole world; the new church of the *Annunciata*, built by the *Lomellini*, for curious painting, rich altars, and exactneſs of architecture, is incomparable; the ſteps, which lead up thereto, are ſo many, and of ſo large a compaſs, being ſemicircular, that they may contain about 1000 perſons upon them at once; the *Duome* alſo, and the churches of the *Theatins* are very ſtately and curious. *Oct.* 14, in the evening, we ſet ſail from *Genoa*. *Oct.* 18, in the afternoon, we made the iſland *Gorgonia*, about nine leagues from *Livorne*, which is a ſmall round iſland with a caſtle on the top. *Oct.* 19, in the morning, we came to anchor in *Livorne* road, about a mile from the town; the road is large and ſecure, eſpecially to the northward. *Livorne* is the great magazine of trade for the *Levant*, being a free port; merchants of all countries reſide here, eſpecially *Armenians* and *Jews*, which latter enjoy great privileges; they are allowed the public exerciſe of their religion; their ſynagogues are large and handſome. The port inwards, has a *Mole* for the duke's gallies, and other ſmall veſſels to ride in; the entrance of which is chained up every night; hard by is the ſtatue of Duke *Ferdinand* in marble, raiſed upon a high pedeſtal, under which are four ſlaves in braſs, in different poſtures, very large, and above the ordinary proportion, but done with exquiſite and admirable art; there are two caſtles towards the ſea, well fortified; the walls of the town are very high, and the four gates are ſtrongly guarded; below which is a ditch of about 15 or 20 yards over, and very deep; no ſtranger is allowed to view the works, nor ſoldier permitted to

come

come out of the caſtles; about 4000 ſlaves are locked up in the bagnio every night; the piazza, where the merchants meet, is adorned with marble pillars, which ſuſtain the portico's, at the eaſt end of which is the great church, whoſe roof appears very glorious, having ſeveral circles richly gilded, and painted with curious figures; the broad ſtreet is paved between two and three yards on each ſide with free-ſtone. *Oct.* 30, we weighed out of *Livorne* road. *Nov.* 5, in the evening, we ſaw the eruptions of fire from *Stromboli*, which lies to the N. W. of *Sicily*; ſometimes it flamed very bright, like a beacon; at other times, there appeared only a glowing kind of light, like that of an ordinary ſtar, when the air is thick and hazy; it is ſaid to flame moſt in rainy weather. *Nov.* 6, in the morning, we were up within a league of it, and we plainly perceived it to ſmoke; it is of a round figure, and may be about three or four miles in compaſs; not far from it lie ſcattered ſeveral other iſlands, called by the ancients *Æolia* and *Vulcaniæ*; amongſt which are *Lipara*, a long flattiſh iſland, and *Vulcanello*, which ſmokes moſt. This afternoon, we came to an anchor in eight fathom water in the *Pharos* of *Meſſina*, in the mid-ſtream between *Scylla* and *Charibdis*, a violent current ſetting againſt us, and the wind not high enough, we were not able to ſtem it; the breadth of the *Streight* from *Meſſina* to *Rhegium* may be about a league; the land is very high on the *Calabrian* ſide, where are very ſteep rocks, and a great depth of water, above 150 fathom; but on the *Sicilian* ſide, near *Charibdis*, ſhallow water, and uſually an eddy; on the ſandy banks ſtands the *Pharos*, or watch-tower; the meeting of ſeveral currents, in this narrow paſſage, cauſes a great ripling; and the danger is, leſt the ſhip be driven to either ſide. *Nov.* 7, we ſailed by *Ætna*, now called *Mongibel*, where the ſea widens 10 or 11 leagues over; the uppermoſt part of the mountain was covered with ſnow, except ſome ſtreaks of aſhes, which lie as it were, in gutters, here and there. *Nov.* 13, we were up with cape *Modona*, the ſouthermoſt cape of the *Morea*, and we ſailed by *Coron*; the land is very high, the hills of *Arcadia* lying eaſtwards from us; the weather was exceſſive hot at this time, as it is at *Midſummer* in *England*. *Nov.* 14, in the evening, we ſailed between the iſland of *Cerigo*, and the mainland of *Greece*, it being about three leagues over to cape *Angelo*. *Nov.* 15, we entred the *Arches*, and ſteered thro' the north channel, leaving *Melo* and *Antimelo* on the ſtarboard quarter, at ſome leagues diſtance.

distance. *Nov.* 16th, betimes in the morning we were a-thwart *Negropont*, and sailed between it and *Andros*; the *Bocca* lies S. W. and N. E. *Nov.* 17th, we sailed by *Chios* or *Scio*, which is very mountainous towards the middle; it is about 4 leagues distant from *Cape Caraboroun*, or the *Cape* of the *Black Nose*, as the *Turkish* word signifies, and by the seamen called *Cape Jobber-nowl*, in their usual way of corrupting names; it is the *Corinæum* of the ancients, a promontory of the famous mountain *Mimas*, which runs along the southern side of the bay of *Smyrna*. *Nov.* 18th, we got into the bay of *Smyrna*, and came to an anchor without the castle, not far from St. *Jacomo*'s *Point*, as the seamen call it, or rather *Sangiac Point*; in the evening we heard a great howling of jackals upon the hills, *Dec.* 8th, we took our leave of *Smyrna*, and the 20th we sailed between *Scio* and *Mitylene*; the 21st, we passed by *Lemnos*, and were up with the island *Tenedos*, a fine champaign country, with only one hill towards the middle of it; we saw the ruins of *Troas* at a distance. The 22d, we entred the *Hellespont*, which may be about 2 ½ leagues over; the narrowest part of the *Hellespont* is at those two castles, called by the Christians the *Dardanelli*, at which are situated the towns *Sestos* and *Abydos*, so famous in *Greek* poetry. The 23d, we passed by St. *Stephanos Point*, where we had a full view of the S. E. angle of *Constantinople*, which, being situated upon several hills to a mighty advantage; what with the cypress trees intermixed, and what with the gilded spires of the mosques, yielded us a very agreeable and glorious prospect; passing by the *Seraglio Point*, which we saluted by a discharge of several guns, we came to anchor in the mid-stream between it and *Tophana*. The 26th, on St. *Stephen*'s day the ambassador landed at *Galata*, and was received there by the *Chiaus Basha*, and the *Vaivod* of *Galata*, attended by the *Janizaries* and *Chiauses*, and by them was conducted to his palace; and soon after, the *Kaimacam*, or governour of *Constantinople*, sent an officer to compliment him upon his arrival, the *Grand Signior* being then at *Larissa* in *Thessaly*.

Being upon the coasts of *Greece*, about *Aug.* or *Sept.* 1669 in the lat. of 35° 33', we found by our azimuth-compass, that we had westerly variation there 5 deg. 22 min.

The variety of colours of the sea-water at different times does chiefly depend upon the wind and weather, and the reflexion of light; its usual and most natural colour is a deep green, but in cloudy and rainy weather, the surface of the sea appears blackish; sometimes the water is of a perfect azure colour, as we observed for

Fig. I.

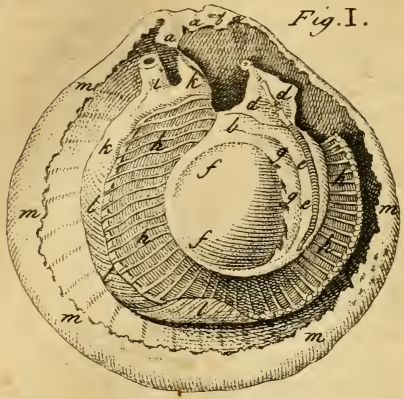


Fig. V.

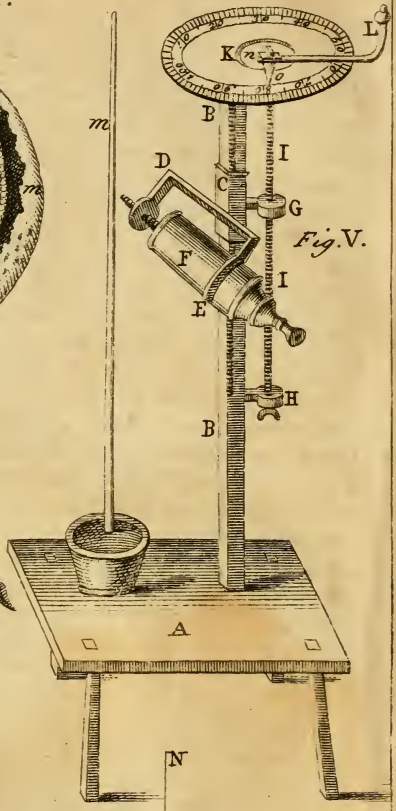


Fig. IV.

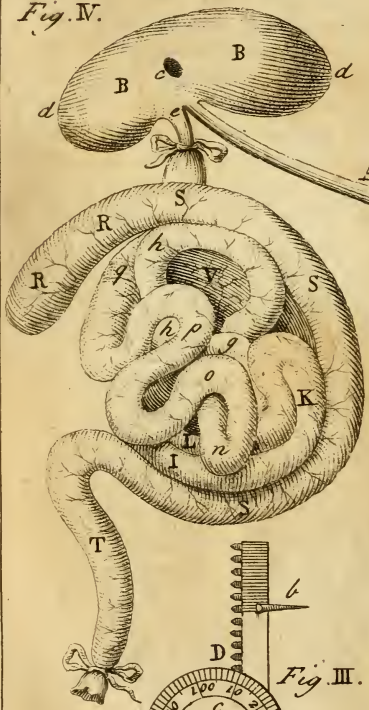
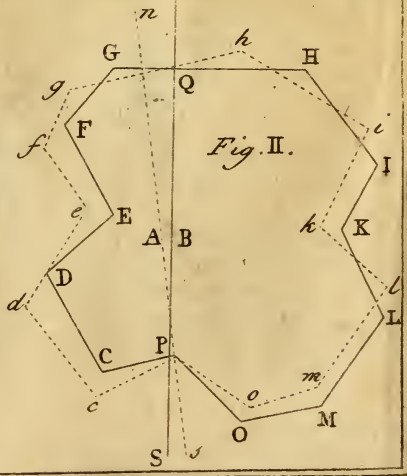


Fig. III.

Fig. II.



for ſeveral weeks in the *Mediterranean*; when the ſun ſhines bright upon the water, ſometimes the upper part of the wave appears purpliſh, ſometimes reddiſh, tho' in ſhallows, but it may receive this latter tincture from the ſands which lie under it. When the wind has freſhened, and the ſhip has been under full ſail, Dr. *Smith* obſerved the waves at the head and ſides of the ſhip, to appear of a pale kind of brightneſs.

Sailing towards the weſt of *Portland*, we ſaw ſeveral porpus's playing, with their heads above water; we alſo obſerved a great part of the *Propontis* covered with them; and of theſe, *Julius Solinus* is to be underſtood, and not of dolphins, tho' he uſes the word *Delphin*; for no dolphins are caught in thoſe ſeas by the *Greeks*, whoſe poverty, added to their love for fiſh, and the advantage ariſing therefrom, on the account of their ſolemn faſts and abſtinences from all ſort of fleſh, has made them excellent fiſhermen.

An Error of common Surveyors, *in comparing* Surveys *taken at long Intervals of Time with the magnetic Needle, demonſtrated; by Mr.* Will. Molyneux. Phil. Tranſ. N° 230. p. 625.

THE variation of the magnetic needle is ſo commonly known, that the explication thereof need not much be inſiſted on; it is certain, that the true ſolar meridian, and the meridian ſhewn by a needle, agree but in very few places of the world; and that too, but for a little time, the difference between the true and magnetic meridians perpetually varying, and changing in all places, and at all times; ſometimes to the eaſtward, and ſometimes to the weſtward. On which account it is impoſſible to compare two ſurveys of the ſame place, taken at diſtant times by magnetic inſtruments, without due allowance be made for this variation; but this is not to be underſtood, as if a map of the ſame place, taken by magnetic inſtruments at never ſo diſtant times, ſhould not at one time give the ſame figure and contents, as at another time; this certainly it will do moſt exactly, the variation of the needle in no manner affecting either the ſhape or contents of the ſurvey; all that is influenced thereby is the bearings of the lines run by the chain, and the boundaries between neighbours; and how this may cauſe a conſiderable error, unleſs due allowance be made for it, is fully proved thus; let A, B, Fig. 2. Plate VII. repreſent the ſurvey of two lands, one in the poſſeſſion of A, and the other in the poſſeſſion of B, taken, for

inſtance, *Anno* 1657, when there is ſuppoſed no variation; let the line N S, running thro' the point P, be the true meridian, and conſequently the magnetic meridian alſo at that time; and let this line N S, be alſo the boundary between the two lands A and B; in 1695, when the variation is ſuppoſed to be 7° from the north weſtwards, B having a map of the former ſurvey, and ſuſpecting that his neighbour A had encroached upon him, by a ditch P Q, employs a ſurveyor to enquire into the matter; the ſurveyor finds, by his map, that the boundary between B and A runs from the point P thro' a meadow, directly according to the magnetic meridian S P N; but obſerving the ditch P Q thrown up much to the eaſtward of the preſent magnetic meridian, he concludes, that A has encroached upon B, and that the ditch ought to have been caſt up along the line P *q*, the angle Q P *q* being an angle of 7°, that is, the variation of the needle, and the line P *q* the magnetic meridian; for which variation, the ſurveyor, not making any allowance, poſitively determines, that B has all the land in the triangle Q P *q*, more than he ought to have, and that his ditch ſhould run along the line P *q*. It is true indeed, if the ſurveyor go the whole round of the land A and B, he will find their figure and contents exactly agreeable to the map; but then the bearings of the lines are all 7° different from the bearings in the map, and they will run in and out upon the adjacent neighbouring lands, and cauſe endleſs diſputes between their poſſeſſors; as is manifeſt from the figure, wherein the pricked lines repreſent the diſagreement in the bearings of the lines, protracted from the point P; and we ſee A encroaching on his neighbours to the weſt, as he himſelf encroaches upon B; whereas, by a due allowance for the variation of the needle, all this confuſion is avoided. What is here ſaid on ſuppoſition, that the magnet had no variation at the time of the firſt ſurvey, and that it had 7° variation to the weſt, at the time of the ſecond ſurvey, may eaſily be accommodated to any other variations; for knowing the variations, we know their difference, and if we know their difference, this gives us the angle Q P *q*, by which we reduce them to each other; the beſt way therefore to make maps invariable, were for the ſurveyors, who uſe magnetic inſtruments, to make always allowance for the magnetic variation, and to protract and plot by the true meridian.

Perhaps it may be objected, that ſurveys may be taken without magnetic inſtruments, and that therefore this error, ariſing

arising from the magnetic variation, and change of the bearing of lines, may be avoided. Tho' a survey may be taken truly without magnetic instruments, so as to shew the exact angles, and lines of the plat, and consequently the true contents; yet this will not give the true bearings of the lines, or shew, for instance, my position in respect of my neighbours, or other parts of the country; this must be supplied by the magnet, or something equivalent thereto, as finding a true meridian line on your land by celestial observations; and Mr. *Molyneux* doubts not, but the ancient *Egyptians*, before the discovery of the magnet, were forced to some such expedient in their surveys, and applotments of land, after the inundations of the *Nile*; which, we are told, gave the first rise to geometry and surveying; and this leads to another objection, which may be made against the instance before laid down; it may be said, that the surveyor, which B employed, was very ignorant, who would chuse to judge of the line PQ rather by its bearing, than by determining the point Q by measure from H to G. To this it is answered, what if both the points H and G were vanished since the survey was taken; what if the whole face of the country were changed, save only the point P, and the line PQ; how shall the surveyor then judge of the line PQ, but by its bearing? That this is no extravagant supposition, we have an example in *Egypt*, where the *Nile* lays all flat before it, and so uniformly covers all with mud, that there is no distinction; in such a case, your bearing must certainly help you out, there is no other way. But, secondly, to say that the surveyor might have determined the point Q by admeasurement from G to H, or any other adjoining noted points, as from F, K, I, *&c.* is very true, but then it is against our supposition; we are now shewing an error, that arises from judging of the line PQ by magnetic bearing, and to say that this might be avoided by another way, is to say nothing; it has been shewn already, how it may be avoided, *viz.* by allowing for the variation, but still it is an error till it is avoided. But, thirdly, if B's surveyor do not allow for the variation of the needle, he will never exactly determine even the points G, F, H, K, *&c.* or any other points in the plat, but instead thereof, he will fall on the points *g*, *h*, *f*, *k*.

From what has been said, we may see the absolute necessity of allowing for the variation of the magnet, in comparing old surveys with new ones; for want of which, great disputes may arise between neighbouring proprietors of lands; and it were

to be wiſhed, that our honourable and learned judges would take this matter into their conſideration, whenever any buſineſs of this nature comes before them.

The Cauſe of Hail, Lightning, *and* Thunder; *by Dr.* Wallis. Phil. Tranſ. N° 231. p. 653.

THunder and lightning are ſo very like the effects of fired gun-powder, that we may reaſonably judge them to proceed from like cauſes. Now the principal ingredients in gun-powder are nitre and ſulphur, the admixture of charcoal being chiefly deſigned to keep the parts ſeparate, for the better kindling of it; ſo that if we ſuppoſe in the air a convenient mixture of nitrous and ſulphureous vapours, and thoſe by accident to take fire, ſuch exploſion may well enſue, as in the firing of gun-powder; and being once kindled, it will run on from place to place, as the vapour leads it, as in a train of gun-powder. This exploſion if high in the air, and far from us, will either do no miſchief, or none very conſiderable, like a parcel of gun-powder fired in the open air; but if it happen to be near us, or amongſt us, it may kill men or cattle, tear trees, fire gun-powder, break houſes, or the like, as gun-powder would do in the like circumſtances. Now this diſtance may be eſtimated by the interval of time between ſeeing the flaſh of lightning, and hearing the noiſe of the thunder; for tho', in their generation, they may be ſimultaneous, yet light moving faſter than ſound, they come to us ſucceſſively. Dr. *Wallis* obſerved that, commonly, the peal is about ſeven or eight ſeconds after the flaſh, that is, about half a quarter of a minute; but ſometimes, it is much ſooner, as in a ſecond or two, or leſs than ſo, and almoſt immediately upon the flaſh; and at ſuch times, the exploſion muſt needs be very near us, or even amongſt us; and in ſuch caſes, Dr. *Wallis* has more than once preſaged the miſchievous conſequences, which accordingly happened. Now that there is in lightning a ſulphureous vapour is manifeſt from the ſulphureous ſmell which accompanies it, eſpecially when any miſchief is done by it, and even when there is none, from the lightning itſelf, which is more or leſs diſcernible; and a ſultry heat in the air is commonly a forerunner of lightning, which is ſoon after to enſue; and that there is alſo a nitrous vapour therein, we may reaſonably judge, becauſe we know of no other body ſo capable of a violent and ſudden exploſion as nitre. Now as to the kindling of theſe materials, in order to ſuch exploſion, Chemiſts obſerve that a mixture of ſulphur, filings of ſteel, and a little water,

water, will not only cauſe a great effervescence, but will of itſelf break forth into an actual flame; ſo that there is only wanting ſome chalybeate or vitriolic vapour, or ſomething equivalent thereto, to produce the whole effect, there being plenty of aqueous matter in the clouds; and there is no doubt, but that amongſt the various effluvia from the earth, there may be copious ſupplies of materials for ſuch admixtures; and it is alſo known that hay, if laid up too green, will not only heat, but take fire of itſelf.

The ſame account may alſo be given of *Ætna* and other burning mountains, where the admixture of ſteel and ſulphur may give a flame; which is often attended with prodigious exploſions, and earthquakes, from the great quantities of nitre, as in ſpringing a mine.

This may alſo ſuggeſt ſomething towards the accounting for the generation of hail, which is very often an attendant on thunder and lightning. It is well known in our artificial congelations, that a mixture of ſnow and nitre, or even common ſalt, will cauſe a preſent and very ſudden congelation of water; and the ſame in the clouds may cauſe hailſtones; and the rather, becauſe not only in thoſe prodigiouſly large, but alſo in common hailſtones, there ſeems ſomething like ſnow rather than ice in the middle of them. And as to thoſe in particular ſo very large, as to weigh half a pound, or three quarters of a pound, ſuppoſing them to fall from a great height; it is very poſſible, that tho' their firſt concretion, on their ſudden congelation, might be but moderately great, as in common hail, yet in their long deſcent, if the medium, thro' which they fall, were alike inclined to congelation, they might receive a great acceſſion to their bulk, and divers of them incorporate into one; like to that ſtrange ſhower of hail in *Dec.* 1672, wherein, a great deal hung on the trees in form of icicles, a foot or more in length.

Obſervations at Cape Corſe; *by Mr.* J. Hillier. Phil. Tranſ. N° 232. p. 687.

OCT. 3d, 1687, *Ahen Penin Aſhrive*, king of *Fetu*, died here at *Cape Corſe*, where he had been long ſick. The *Fetiſhers* had done all they could to ſave his life, but all was to no purpoſe, their phyſic ſcarcely extending to any thing but the flux, and what we call the *French* diſeaſe; his diſorder was a conſumption, and an aſthma of a long continuance; ſo they had recourſe to their religion, and according to the rules of that, they made ſeveral pellets of clay, which they ranged in order in his chamber, all beſprinkled with blood; beſides, they eat ſeveral muttons

muttons to his good health; but all proved of little efficacy, and ſo the king died, having delivered his ſword to the *Dey*, who, in the *interregnum*, was to be the principal man, for the kingdom is elective; he alſo appointed one of his wives, whom he thought worthy of that fatal honour, to accompany him to the other world; the moſt conſiderable amongſt them ſent in thoſe they had a mind to kill in honour of the king. After the king's funeral, the next thing was to chuſe a ſucceſſor; they pitched upon the *Dey* himſelf, tho' not of the blood royal, the reaſon was, as they ſaid, becauſe he had power enough to do what he pleaſed, and they could do nothing againſt him; but the *Dey* refuſed the honour, on account of the charges it would put him to, and he propoſed the brother of the deceaſed king; ſo the buſineſs ſtuck for ſome time, but at laſt it was agreed, and king *Aſhrive*'s brother was declared king.

The manner of their ordinary executions is thus; the criminal is made to drink a great deal of palm-wine, and to dance, whilſt in the mean time he is puſhed from one ſide to the other; after this, he is thrown down with his face into the ſand; then his legs are cut off below the knees, and his arms below the elbows; after that, his thighs, and his arms below the ſhoulders, and laſtly his head. When any one has got new drums or trumpets, they muſt be conſecrated with human blood.

The ſhore lies almoſt eaſt and weſt, wholly expoſed to the ſea on the ſouth; the country is hilly, the hills are not very high, but lying thick and in cluſters, the vallies between are extremely narrow; the whole is in a manner covered with certain low, but very thick ſhrubs; not the tenth part of the ground is tilled, and where they do till, within half a year the ground is overgrown as before; for they do not root up the ſhrubs, but only cut, and ſometimes burn them cloſe to the ground; ſo they ſpring up again in a little time; this however is ſufficient for planting their corn, which they do by making ſmall holes in the earth at a competent diſtance, and putting ſeeds into them; the people are entirely lazy, but ſubtle, and apt to cheat the unwary. The water, which they have in pits, and which is for the moſt part rain-water, has a mixt taſte of ſweet and ſubacid; at *Widdah*, one of the moſt unhealthy places in *Guinea*, he, that opens the ground, runs the hazard of his life, ſo noxious are the ſteams ariſing from it. The age of the inhabitants is very uncertain: Much of the mortality amongſt ſtrangers, is owing to their irregular diet, whilſt they drink to exceſs of very hot and ſpirituous liquors; and ſhould any one chuſe cold liquors rather, his ſtomach

mach is chilled, and he is in danger of a flux, and that immediately: Again, men are not ſo careful to guard themſelves from the air; for the air here, tho' not ſo cold, is much more ſubtile and piercing than in *England*, and it corrodes iron ſooner, but not by moiſture, for the air is not ſo moiſt; in rainy weather the mortality is obſerved not to be ſo great.

The Diſſection of a Leech; *by Mr.* Poupart. Phil. Tranſ. N° 233. p. 722.

THE upper lip of a *Leech* is ſtretched out into a point, and falls upon the under lip, which is round like a creſcent, and ſhorter; its throat, on the inſide, is covered with a great many white muſcles, about 5 or 6 lines long, as large as a ſmall thread, and lying parallel to each other, along its body; when it applies the mouth to the fleſh of any animal, all theſe muſcles contracting themſelves, it ſucks with ſo great violence and greedineſs, that the part becomes of the form of a ſmall nipple; ſo that all the effect of ſuction terminating in a very ſmall ſpace, of neceſſity the fleſh muſt break in that part. There is ſeen at the extremity of its tail, a little flat part, exactly round, the border of which is elevated far above the tail, and all round it; and this it applies ſo uniformly to the bodies on which it faſtens, that it touches them in all their parts, and then drawing up a little the middle of this flat part, without taking off the edges, ſhe makes of it, as it were, a little balm, and leaves a cavity in the middle; this excellent glue ſticks ſo ſtrongly to the tail of the leech, that it is a hard matter to pull it away without making ſome rent, eſpecially if you draw it perpendicularly from the ſurface on which the animal is faſtened; it has always recourſe to this little inſtrument, for faſtening its body, to the end it may not be ſuſpended in the air, whilſt it draws nouriſhment by ſuction, or elſe that it may not be carried away with the current of water, whilſt it moves its head to and fro' in ſearch of food. Its gut goes in a ſtreight line from the mouth to the *Anus*, it is as large as a gooſe quill, and all along beſet with a great number of little valves; ſome of which make a perfect circle with a hole in the middle, and others a half-moon; ſome are ſhaped ſpiral-wiſe, and of theſe there is a large one near the tail, faſhioned like the heart, which leaves only a very little hole, near which is found a great deal of yellow fat, which fills all the cavity of the inteſtine to half an inch; there are two ſmall inteſtines or appendixes, each half an inch in length, and as large as the feather of a ſmall bird's wing, which open into the great gut, and are ſhut at the other

other end; this whole ſtructure affords a reaſon, why the inteſtine, which makes no convolutions, and yet reſerves ordinarily but liquid aliments, does yet retain them to a perfect concoction. There is a nerve, of the bigneſs of a horſe-hair, all black, hard to break, with knots at proper intervals, which begins at the mouth of the animal, and paſſes over the parts, that ſerve for generation in the male; it is faſtened in a ſtreight line all along the upper part of the gut, terminates at the little circle in the end of the tail, and in its way ſends out branches from each knot both to the right and left; it is very probable, that by this canal, the animal ſpirits run plentifully, which give ſo great briſkneſs to this reptile, and cauſe it to ſwim ſo ſwiftly, and ſuck with ſuch greedineſs. The leech is hermaphrodite; the parts of the male deſtined for generation are placed where the neck ſhould be; the yard, which is above two inches long, is white, round, hollow and griſtly; a part of the yard, which is always in the body, is a ſheath, about 17 lines of an inch in length, and as big as a ſmall bird's quill, covered with a fine membrane, which faſtens it ſtrongly to the belly, round about a ſmall hole given the leech for exerting its *Penis* at pleaſure, and not for breathing as the ancients thought; the other part of the yard, which comes out 9 or 10 lines of an inch, is of the bigneſs of a ſewing thread, and its extremity, for the length of two lines, is bigger than the reſt; all the yard is hollow, and hath in its cavity a white muſcle, as big as a hair, faſtened only to the root and head, all the reſt being at liberty; it is by this muſcle that the animal retracts the *Penis* into its ſheath, which any one may try, by cutting it at the root, and drawing out this muſcle with his nails; on every ſide of the root of the yard there is a ſmall white flat oval web, about two or three lines in length, reſembling ſmall guts, twiſted about with a cartilaginous body, as big as a double thread, and two lines in length, faſtened to the root of the yard, which probably contains the prolific matter; a little above the root of the yard, between theſe two webs, there is a ſmall griſtly globules, which M. *Poupart* takes to be a teſticle, two inches long, and which is white, hard, hollow, round, oval, ſharp, internally covered with a membrane, wrinkled and full of a milky liquor; at the head of this globule there is a ſmall web, like to an *Epididymis*, whoſe little canal, of the ſame piece therewith, creeps over the globule, and is faſtened at its point; and above the *Epididymis* there are two glands exactly round, each as big as a millet ſeed; all along every ſide of the inteſtine, there is a white canal, or *Ovarium*, of the bigneſs of a ſmall twiſted thread, and folded a thou-

thouſand ways, to which are faſtened by a tail many ſmall globules exactly round, as big as a ſmall pea, full of a milky juice, and ſome ſmall white eggs, griſtly, perfectly round, as big as a millet ſeed, hard, and full of a white matter; in the inteſtine towards the extremity, there is a large valve faſhioned like a heart, with two little bags, where begin a thouſand ſmall channels, made of fine yellow fat, which fill the cavity of the inteſtine for half an inch; it is probable that theſe paſſages of fat receive the prolific liquor in order to conduct it into the *Ovarium*.

Obſervations in the Weſtern Iſles of Scotland; *by Mr.* Martin. Phil. Tranſ. N° 233. p. 727.

ALL the tribe of fowl are obſerved to have their ſentinels, eſpecially in the night; the watchfulneſs of the ſcart is true to a proverb: The want of rain at the uſual time of laying eggs hinders the ſea-fowl from laying for ſome time: If the *April* moon go far in *May*, the ſea-fowl lay 10 or 12 days later than ordinary: A poor man of *Rowdil* in the iſle of *Harries*, known by the name of St. *Clement*'s *Blind*, tho' his ſight ſerved him to travel alone, yet he was always ſtruck blind two days before the new moon, which confined him to his bed, but at that inſtant he recovered his ſight; in this he never failed once in his lifetime, for which reaſon he was called the infallible almanac: The children in *Ferrintoſh* in *Roſs* are taught from their infancy to drink *Aqua Vitæ*, and are never obſerved to be troubled with the worms: There are many in the *High-lands*, who pretend not to any ſkill in ſurgery, and yet venture to cut off the *Uvula*, when they are troubled therewith, and preſcribe with ſucceſs for a remedy after it a piece of bread and cheeſe: In many of the iſles, for head-aches the common people apply ſpear-wort; for being bruiſed and applied, it raiſes a bliſter, from which a great deal of matter runs; and this they find very effectual in pains in the eyes, head, arms or legs: They alſo drink with good ſucceſs its expreſſed juice for a purge; and to prevent the excoriation of the throat, they drink a little melted freſh butter: *Ann George* was married in the 51ſt year of her age, and was afterwards delivered of a child with two teeth: Another woman in *Lewis* was ſeven years bringing forth a child by piece-meal, and all by the fundament: A boy in the *Iſle* of *Skye* had a faculty of erecting his ears at pleaſure: There are ſeveral towns in *Skye*, where the ſheep have no marrow, and theſe are rocky, high, and much expoſed to the wind: The inhabitants of St. *Kilda* are every ſummer infeſted with a cough upon the chamberlain's landing,

which continues for 10 or 12 days; and the usual remedy for it is *Gibben* drank upon *Brochan*, or water-gruel; this *Gibben* is the fat of sea-fowl preserved in the stomach, and it is a sovereign remedy for coughs, and green wounds.

Roman *Antiquities about* York *and* Leeds; *by Mr.* Thoresby Phil. Transf. N° 234. p. 737.

MR. *Thoresby* found two entire urns, both of bluish gray clay, but of different forms, with some of the burnt bones, besides two other vessels of red clay; the lesser of them was almost in the form of the *Roman Simpulum*, or *Guttus*, and by the narrowness of the neck it seemed rather to have been a kind of *Lachrimatory*, or vessel for some sort of liquid matter, rather than for ashes; the other was part of an aqueduct, and turned in the form of a screw on the inside, with a narrow neck at one end, to put into the open of the next; and several of these, each a foot long and four inches broad, were found thus placed in the *Roman* burying-place at *York*, by the river side, without *Boutham-Bar*, which, according to the learned Dr. *Gale*, signifies burning, in the *British* language; and it was doubtless the place the *Romans* made use of for that purpose, as appears by the great number of urns, frequently found there, in digging clay for bricks; and that it continued the place of their sepulture, after the custom of burning, which was introduced in the tyrannical dictatorship of *Sylla*, was abolished, is evident by a remarkable *Hypogæum* without any urn therein discovered in 1696; it was large enough to contain two or three corpses, and paved with bricks, which were nearly two inches thick, and eight in breadth and length; on this there was a second pavement of the same *Roman* bricks to cover the seams of the lower, and prevent the working up of vermin; but those, that covered the vault, were the most remarkable, being about two foot square, and of a proportionable thickness; Mr. *Thoresby* discovered also a third sort of *Roman* bricks in the ruins of *Kirkstal-Abbey*, two miles from *Leeds*, which come the nighest those mentioned by *Vitruvius*, being 8 inches broad, and almost double the length.

Swarms of Beetles *in* Ireland; *by Dr.* Tho. Molyneux. Phil. Transf. N° 234. p. 741.

THESE swarms of insects were first observed in 1688; they appeared on the south-west coast of the county of *Galway*, being brought thither by a S. W. wind, one of the common, or rather trade-winds of *Ireland*; from hence they pene-

penetrated into the more inland parts, towards *Hedford*, about 12 miles north of the town of *Galway*; here and in the adjacent country vaſt numbers of them appeared amongſt the trees and hedges in the day-time, hanging from the boughs in cluſters, like bees when they ſwarm; and in this clinging poſture they continued, with little or no motion, during the heat of the ſun; but towards evening, or ſun-ſet, they would all ariſe, diſperſe, and fly about, with a ſtrange humming noiſe, much like the beating of drums at ſome diſtance, and in ſuch incredible numbers, that they darkned the air for the ſpace of two or three miles ſquare: Such, as were travelling on the roads, or abroad in the fields, found it very uneaſy to make their way thro' them, they would ſo beat and knock themſelves againſt their faces in their flight, and with ſuch a force, as to make the place ſmart, and leave a ſlight mark behind them: In a little time after their coming, they had ſo entirely eaten up and deſtroyed all the leaves of the trees for ſome miles round about, that the whole country, tho' it was in the middle of ſummer, was left as bare and naked as if it had been the depth of winter; and their gnawing of the leaves made a ſound very much reſembling the ſawing of timber: They alſo came into the gardens, and deſtroyed the buds, bloſſoms, and leaves of all the fruit trees, ſo that they were left perfectly naked; nay, many of them, that were more delicate and tender than the reſt, loſt their ſap as well as leaves, and quite withered away, ſo as never to recover again: Their numbers ſpread ſo exceedingly that they infeſted houſes, and proved very troubleſome and offenſive: Their numerous creeping ſpawn, which they had lodged under ground, next the upper ſod of the earth, did ſtill more harm, in that cloſe retirement, than all the flying ſwarms of their parents had done abroad; for this young deſtructive brood, lying under ground, devoured the roots of the corn and graſs, and thus deſtroyed both the ſupport of man and beaſt: This ſpawn, when firſt it gave ſigns of life, appeared like a large maggot, and by taking food, and encreaſing every day, became a bigger worm, till at length it grew as big as a large white caterpillar; and from this, according to the uſual tranſformation, natural to theſe ſmaller animals, there ſprang this flying inſect: This plague was happily checked ſeveral ways; high winds, wet and miſling weather deſtroyed many millions of them in a day; whence we may conclude, that tho' we have them in thoſe northern moiſt climates, yet they are more natural and peculiar to warm and dry countries: Whenever this bad conſtitution of the air prevailed, their bodies were ſo enfeebled, that they

would let go their holds, and drop to the ground from the branches on which they ſtuck, which fall was ſufficient quite to diſable them, and ſometimes entirely kill them; nay, it was obſervable, that even when they were moſt vigorous, a ſlight blow would for ſome time ſtun them, if not deprive them of life: During theſe unfavourable ſeaſons of weather, the ſwine and poultry would watch under the trees for their falling, and feed and fatten upon them; and even the poorer ſort of the native *Iriſh*, the country then labouring under a ſcarcity of proviſions, had a method of dreſſing them, and lived upon them as food: It was ſoon found that ſmoke was very offenſive to theſe flies; and by burning heath, fern, and ſuch like weeds, they ſecured their gardens, and prevented their incurſions, or if they had already entred, they drove them out again: Towards the latter end of ſummer, they conſtantly retired of themſelves, and wholly diſappeared in ſuch a manner, that in a few days you could not ſee one of them left; ſome thought, that they took their flight, like ſwallows and other birds of paſſage, to a more diſtant country and warmer climate; but the true reaſon of their diſappearing, Dr. *Molyneux* takes to be, that after the time of their coition is over, it being about that time that they are obſerved to couple, by faſtening to each other by their tails, they retire under ground, in order to lay their ſpawn there for a ſucceeding generation, and likewiſe to compoſe themſelves to ſleep for the reſt of the enſuing year, as ſeveral other animals are known to do; as ſnails, amongſt inſects, the hedge-hog amongſt the beaſts, and the *Ortygometra*, or rail, amongſt the birds; and what farther confirms this opinion is, that in the ſpring-time, on digging or ploughing up the ground, great neſts of them were frequently diſcovered and broken up, where whole buſhels were found together in one heap, but in ſuch a quiet condition, that they ſeemed to have but little life and motion; theſe large caverns, to which they retired, were often met with under a firm, ſolid ſurface of earth, and no manifeſt paſſage could be diſcovered, by which they could get in. In ſummer 1695 or 96, all along the ſouth-weſt coaſt of the county of *Galway*, for ſome miles together, there were found dead on the ſhore ſuch infinite numbers of them, and in ſuch vaſt heaps, that by a moderate computation there could be no leſs than 40 or 50 horſe-loads in all; theſe, according to Dr. *Molyneux*, were a new colony, or ſupernumerary ſwarm, from the ſame place whence the firſt ſtock came in 1688, driven by the wind to ſea from their native land, which he takes to be *Normandy* or *Brittany* in *France*, it being a country much infeſted with

with this insect, and from whence *England* heretofore has been infested in the same manner; but these meeting with a contrary wind, before they could reach land, their progress was stopped, and tired with their voyage, they were all driven into the sea, which, by the motion of its waves and tides, cast their floating bodies in heaps upon the shore: It is observed, that they seldom keep above a year together in one place, and their usual stages, or marches, are computed to be about six miles in a year; hitherto their progress has been westerly, following the course of that wind, which blows most commonly in that country.

These insects have been erroneously denominated locusts; but the true locust, much resembling in shape a common grashopper, tho' larger, is quite a different species of insect from this, which belongs to that tribe, called by naturalists Κολεοπτερα, *Vaginipennis*, the *Scarabæus*, or beetle kind, that has strong thick cases to defend and sheath their tender thin wings, that lie out of sight, and next the body; and this species is undoubtedly that particular beetle, called by *Aristotle*, in his history of animals, μηλολανθυς, from its devouring the blossoms of apple-trees, and is the *Scarabæus arboreus* of *Mouset* and *Charleton*, called by the *English*, *Doors*, or *Hedge-chafers*; they are much of the bigness of the common black beetle, but of a browniſh colour, something like that of cinnamon; they are thick set with a fine, short, downy hair, that shews as if they were powdered all over with a fine sort of dust; the cases of their wings do not entirely cover all the back; for their long picked tails, where lie the organs of generation, reach a good way beyond them; and the indentures or joints, on each side their belly, appear much whiter than the rest; they are exactly figured by Dr. *Lister*, *Scarab. Tab. Mut.*

Dr. *Molyneux* declares himself fully persuaded, that this insect is the very same, which the *Septuagint*, and the vulgar *Latin* translation, retaining the *Greek* word, call βρουχος, or *Bruchus*, derived from βρυχω, *Frendeo*, or *Strideo*, intimating the remarkable noise it makes both in its eating and flying; it is often mentioned in holy scripture, *Levit.* 11. 22. *Joel* 1. 4. and 2. 25. *Nahum* 3. 16, 17; but our *English* version almost constantly translates this word, βρουχος, tho' he thinks improperly, cancer-worm; since this only denotes a reptile, whereas that term does certainly denote a flying insect; for the βρουχος. *Nahum* 3. 16, 17. is expressly said to flee, and have wings; and

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it is truly described in these words; *it spoileth, and flyeth away, they camp in hedges in the day, and when the sun ariseth they flee away, and their place is not known where they are*; that is, they then retire again to the hedges and trees, where they lie quiet, and concealed till the sun sets again. Βρυχος is better translated locust or beetle, *Lev.* 11. 22. where *Moses* permits the *Israelites* to eat the locust after his kind, and the bald-locust after his kind, and the beetle after his kind, and the grashopper after his kind. Dr. *Molyneux* owns, that for a long time it seemed unaccountable to him, that beetles, and those other nasty, dry, and unpromising vermin, should be thought as clean and proper food for man; but as it is certain, that *Palestine*, *Arabia*, *Egypt*, and the other neighbouring countries were all extremely infested with these pernicious vermin, and therefore *Moses* foreseeing the great dearth and scarcity that they might one day bring on his people, gives them here a permissive precept, or a hint what they should do, when the corn, grass, olive-trees, fruit-trees, vines, and other provisions were destroyed by the locust and βρυχοι, or beetles swarming in the land; that then for want of other provisions, and rather than starve, they might eat, and live upon the filthy destroyers themselves, and yet be clean: And thus we see the native *Irish* were practical commentators on this part of the *Levitical* law, and by matter of fact explained the true sense and meaning of this, otherwise dark and obtruse text: It is also more than probable, that this same destructive beetle, was that very kind of *Scarabæus*, the idolatrous *Egyptians* of old had in such high veneration, as to pay divine worship to it, and frequently engrave its image on their *Aguglios* and *Obelisks*, as we see at this day; for nothing can be supposed more natural, than to imagine that a nation addicted to polytheism, as the *Egyptians* were, in a country frequently infested with swarms of devouring insects, should from a strong sense and fear of future evil, the common principle of superstition and idolatry, give divine honours to the visible authors of these their sufferings, in hopes to render them more propitious for the future; thus it is allowed on all hands, that the same people adored, as gods, the ravenous crocodiles of the *Nile*; and thus the *Romans*, tho' more polite, and civilized in their idolatry, worshiped fever, *Febrem ad minus nocendam venerabantur, eamque variis templis exstructis colebant*, says *Valerius Maximus*, *L.* 2. *c.* 5.

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The Death of a Dog, *on firing ſome Vollies of ſmall Shot*; *by Mr.* Rob. Clarke. Phil. Tranſ. N° 235. p. 775.

IN *November*, 1697, upon proclaiming the peace, two troops of horſe diſmounted, and were drawn up in a line in order to fire; the centre of their line faced a butcher's door, who kept a very large maſtiff-dog, a dog of great courage for fighting; this dog lay a-ſleep by the fire ſide; but upon the firſt volley, he immediately ſtarted up, ran into a chamber, and hid himſelf under the bed; upon a ſecond volley, the dog roſe, run ſeveral times about the room with violent tremblings, and ſtrange agonies; but upon the third volley, he run about once or twice, and fell down dead immediately, bleeding at mouth and noſe.

A Negro Boy *dappled with white* Spots; *by Mr.* Will. Byrd. Phil. Tranſ. N° 235. p. 781.

THIS *Negro* boy was born about the upper parts of *Rappahanock* river in *Virginia*; his father and mother were both perfect *Negroes*, and the boy himſelf, till he came to be three years old, was in all reſpects like other black children; and then, without any diſtemper, he began to have ſeveral little white ſpecks on his neck and breaſt, which encreaſed with his age, both in number and bigneſs; ſo that from the upper part of his neck, where ſome of his wool was become white, down to his knees, he was all over dappled with white ſpots, ſome of which were broader than the palm of a man's hand; they were exceeding white, at leaſt equal to the ſkin of the faireſt lady, but of a paler white; and the fleſh and blood did not ſhew ſo lively thro' them, as thro' the ſkin of white people; the reaſon of which might be, that the ſkin of a *Negro* is much thicker; his face, arms, and legs were perfectly black.

Concave Specula *of a* Parabolic Figure *attempted*; *by Mr.* Steph. Gray. Phil. Tranſ. N° 235. p. 787.

A Linnen cloth, being firſt wet in fair water, and then laid on a concave cylinder, as the verge of a ſieve, or the like, its central parts will deſcend, ſo as to form a very regular concave ſuperficies; and a thread, being firſt wet in common water, and then ſuſpended with its two ends, or any two points nearer than their utmoſt extent, ſo as to touch the centre of the ſuſpended cloth, with its two oppoſite points on the ring,

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was found to have the ſame curvature; in order to diſcover the figure of the thread, thus ſuſpended, Mr. *Gray* deſcribed ſeveral ſpecies of parabola's, whoſe axes were perpendicular, and perimeters horizontal; to which applying the line, ſo as to touch the vertex, it paſſed very nearly thro' all the intermediate points of the parabola, much nearer than the portion of a circle, which paſſed thro' the extremity of the perimeter, and *Latus Rectum* would do.

From hence he concludes, that a ponderous and pliable ſubſtance, being ſuſpended on a ring, or hollow cylinder, ſo as that its central parts may deſcend, will form itſelf into a figure that is more commodious for burning-glaſſes than the ſpherical, of which they are now made, coming much nearer their moſt abſolute figure, the parabola: Now, if a way could be found to give cloth, or leather, a metalline ſurface, or a varniſh that might bear a good poliſh; or if this be thought impracticable, if plates of metal were beat out ſo thin, as that being ſuſpended on a large ring, they would by their own gravity receive their due figure, *Specula* might be made of any largeneſs: Upon this conſideration, Mr. *Gray* deviſed the following experiment; he took a ſufficient quantity of potter's clay, of which he formed a plane circular plate, by means of an iron ring about 13 inches diameter; this was laid on a leſſer ring, ſupported by four feet, and it immediately became a very regular concave on its upper, and convex on its under ſurface; but notwithſtanding it was ſet to dry in the ſhade, yet before it was dry enough, its central parts were ſo extended as to become almoſt plane, not without ſome defects; if it had continued in its regularity, Mr. *Gray* deſigned to have burned and glazed it in a potter's furnace.

The Height of the Mercury *at the Top of the* Monument; *and a portable* Barometer; *by Mr.* Will. Derham. Phil. Tranſ. N° 236. p. 2.

IN *September*, 1696, Mr. *Derham* obſerved the variation of the mercury on the *Monument*, and found, by one of Mr. *Quare*'s beſt portable barometers, that it deſcended $\frac{1}{10}$ of an inch at the height of 80 foot, and $\frac{2}{10}$ at 160 foot; but ſince that, finding his obſervations a little different from Mr. *Halley*'s on *Snowdon Hill*, he tried it again more nicely, in *November*, 1697, in this manner; he provided a pretty large glaſs tube, well cleaned, which he caſed in wire, and filled it with well ſtrained mercury, which being cleared of air, he then plunged the

the bottom of the tube into a broad ciſtern of mercury, and then fixed both the tube and ciſtern together in a wire-caſe, or frame; on the top he left an eye in the wire, to ſuſpend the whole barometer on a ſtring, that it might hang pendulous, which is abſolutely neceſſary; becauſe, if the ciſtern be deeper on one ſide than another, or if the tube hang more towards one ſide than the other, it will cauſe a great, and erroneous variation in the mercury above, according as the tube ſtands perpendicular or not: His inſtrument being thus very nicely prepared, Mr. *Derham* marked exactly the height of the quickſilver on two narrow labels of paper, paſted on each ſide the tube, both at the bottom, and in his aſcent up the monument; he meaſured the differences of the height of the mercury, with a decimal inch ſcale of thin braſs, and the quantity of his aſcent with a *Gunter*'s chain, becauſe a ſtring would ſtretch; and by the niceſt obſervation he could make, he found that at the height of 82 foot, the mercury fell $\frac{1}{10}$ of an inch, and about 164 foot $\frac{2}{10}$; and repeating the ſame experiment, his obſervations agreed exactly with the firſt trial; from whence he concludes, that at every 82 foot height, or thereabouts, the mercury will deſcend $\frac{1}{10}$ of an inch.

In order to make a portable barometer, provide a ſtrong glaſs tube, let its head be pinched at about an inch from the top, ſo as to form a narrow neck, whoſe orifice ſhall be as big almoſt as a ſtraw; this will check much the blow of the mercury againſt the top; the bottom of the tube is to be ground a-ſlant near half an inch, that the bottom of the tube touching the bottom of the ciſtern, its orifice may lie about the middle of the mercury in the ciſtern, which will prevent the air's getting into the tube, becauſe the mercury is always about the mouth of the tube; the ciſtern muſt be made void, either of glaſs, or cloſe grained wood; round whoſe brim externally, there muſt be a notch to tie on the leather, that is to cover it; when the tube is filled, cleared of air, and plunged into the ciſtern almoſt full of mercury, encloſe the mercury with gentle leather, tied very faſt round the tube near the bottom, which being ſpread over the ciſtern, tie it round that alſo; the tube and ciſtern, thus faſtened with leather, muſt be lodged in a caſe, made fit for receiving both, where they muſt lie very firm; let three or four holes be bored thro' the caſe, to let the air in freely to the leather that covers the ciſtern, which, lying cloſe againſt the holes, will firmly enough keep the mercury from running out at them.

To preserve the Specimens of Plants; *by Sir* Rob. Southwel. Phil. Tranſ. N° 237. p. 42.

PRepare two plates of iron, as large as the ſpecimens you deſign to preſerve; theſe plates muſt be thick, ſo as not to bend, be very ſmooth on one ſide, and have holes for ſcrews on each corner, to ſcrew them cloſe; then take your flowers, leaves, *&c.* when perfectly ripe, and of their true colour, ſpread them on a brown paper, with the leaves as diſtinct as you can; and if the flowers be large, more paper muſt be laid under them; and if thick, you may pare away the one half thereof, as alſo of the ſtalk, ſo as to lie almoſt flat; then lay over the whole more brown paper, and put theſe between the iron plates, ſcrew them cloſe, and put them into an oven for two hours; after which, take out the flowers; then take *Aqua-fortis*, and *Aqua Vitæ*, or brandy, an equal quantity, mixed together, and with a bruſh paſs over the leaves of the flowers; then lay them to dry on freſh brown paper, and preſs them a little with a handkerchief, or with your fingers; then take the quantity of a walnut of gum dragon, which in leſs than 24 hours will be diſſolved in a pint of fair water; and with a fine bruſh rub the back ſides of your flowers and leaves, to make them ſtick; then lay them in your paper book, and they will always look freſh; and if you would give any ſcent to ſuch flowers as have none, touch them with any eſſence you pleaſe.

To make Fruit *and* Flowers *grow in Winter*; *and to keep* Fruit *and* Flowers *a whole Year*; *by Sir* Rob. Southwel. Phil. Tranſ. N° 237. p. 44.

TAKE up trees by the roots in the ſpring, juſt as they put forth their buds, preſerving ſome of their own earth about the roots; ſet them ſtanding upright in a cellar till *Michaelmas*; then put them into veſſels, with an addition of more earth, and bring them into a ſtove, taking care to moiſten the earth every morning with rain-water, in a quart of which the quantity of a walnut of *Sal armoniac* is diſſolved, and about *Lent* the fruit will appear. As to flowers, take good earthen pots, and therein ſow your ſeed at *Michaelmas*, watering it in the ſame manner, with the like water, and by *Chriſtmas* you will have flowers, as tulips, lilies, *&c.* This and the other may be done in a good warm kitchen; and ſuch days as the ſun ſhines, you may ſet them out for ſome hours.

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In order to preſerve fruit and flowers, take ſaltpetre one pound, bole-armoniac two pounds, common clean ſand three pounds; mix all together, and obſerve this proportion in other quantities: Then in dry weather, take fruit of any ſort, which is not fully ripe, each with its ſtalk; put them one by one into an open glaſs, till it is full, and then cover it with an oiled cloth, cloſe tied down; then put each of theſe glaſſes four fingers under ground in a dry cellar, and in ſuch a manner, that quite round each glaſs, and both above and below, there may remain two fingers thick of the ſaid mixture. Flowers may alſo be managed in the ſame manner.

A Method of meaſuring the Height of the Mercury *in the* Barometer, *by a Circle on one of the Weather Plates; by Mr.* Will. Derham. Phil. Tranſ. N° 237. p. 45.

A A, Fig. 3. Plate VII. is a ruler with teeth on one of its edges, made to ſlide up and down; *b* a ſmall index, fixt to the ruler, to be raiſed or depreſſed, till it point exactly to the height of the mercury; CCCC the index-wheel, with juſt as many teeth as there are teeth in an inch of the ſliding ruler; ſo that moving up and down this toothed ruler, you may at every inch turn the index once round; DDDD is a circle divided into 100 parts, anſwering to 100 parts of an inch on the ſliding ruler; *e e* the index, which, being faſtened to the arbor of the index-wheel, is driven round with it, and ſhews on the circle the parts of an inch, which the mercury riſes or falls in the tube.

The Cure for the Bite *of a* Mad Dog; *by Mr.* Geo. Dampier. Phil. Tranſ. N° 237. p. 49.

THE herb is the *Lichen cinereus terreſtris*, deſcribed by Mr. *Ray*; it grows commonly in barren places all over *England*, and very cloſe to the ground; to uſe it, you muſt dry it either in an oven, by the fire, or in the ſun; then powder it, and paſs it thro' a ſcarce, and this mixed with pepper, finely ground, is the compoſition; the doſe is nearly four ſcruples; when given to a dog, or any other animal, they muſt be firſt blooded, and then waſhed well all over; then mix the compoſition well in a convenient quantity of warm milk, or broth; the doſe may be proportioned to the bulk or ſtrength of the animal. To a man or woman it muſt be given after blood-letting, and waſhing well the face and hands, or the place that is bitten, or all the cloaths the patient had on, in

order to wash away the drivel that comes from the mouth of the mad dog; and the patient may take it in warm milk, beer, ale, broth, *&c.* for two or three several mornings; this remedy, when given in time, prevents all signs of madness, and is a noble and infallible medicine.

The true Origin of Caterpillars; *by Dr.* Geo. Garden. Phil. Trans. N° 237. p. 54.

THE bearers of fruit-trees are full of asperities, and not so smooth in their bark, as the other parts of the tree are; if after harvest, and any time in winter, you view these bearers thro' an ordinary microscope, you will find the cavities full of eggs, of an oblong figure, and citron colour; especially in such years and trees, wherein the caterpillars have been numerous; out of these they are hatched in the spring: The seasons which usually destroy them, are such as come in with early heats, sufficient to hatch them, before the coming out of the buds and blossoms, and on which a nipping frosty air ensues, which soon kills them.

The discovery of this manner of their propagation seems to give light to the following conjectures. 1. That we ought not to conclude, that any insects are bred of corruption, and not *ex ovo*, because we cannot discern the particular manner of their propagation. 2. That the female insects of all kinds of flies and butterflies do probably lodge their spawn near those places, where the *Eruca*'s, which are hatched of them, are to have their food. 3. They seem to be fixed to the cavities of the bearers by a glue, so that rains cannot wash them off. 4. The greatest frosts, it seems, do no hurt to the small eggs of insects; for Dr. *Garden* observed caterpillars to hatch, after very cold and frosty winters, of such eggs as were on the bearers all the winter round.

The Division of the Monochord; *by Dr.* Wallis. Phil. Trans. N° 238. p. 81.

ANY string or chord of a musical instrument open, or at its full length, will sound, what we call, an octave, or *Diapason*, to that of the same string stopped in the middle, or at half its length; hence it is, that we commonly assign to an octave, the duple ratio, or that of 2 to 1, because such is the proportion of lengths, taken in the same string, which gives those sounds; and upon a like account, we assign to a fifth, or *Diapente*, the sesqui-alter ratio, or that of 3 to 2; and to a fourth,

fourth, or *Diateſſaron*, the ſeſqui-tertian, or that of 4 to 3; and to a tone, which is the difference of a fourth and fifth, the ſeſqui-octave, or that of 9 to 8; becauſe lengths, taken in the ſame ſtring in theſe ratios, do give ſuch ſounds: And univerſally, whatever ratio of lengths, taken in the ſame ſtring equally ſtretched, gives ſuch and ſuch ſounds, juſt ſuch ratio's of gravity we aſſign to the ſounds ſo given: But when an eight or octave is ſaid in common ſpeech to conſiſt of 12 hemi-tones, or 6 tones, this is not to be underſtood according to the utmoſt rigour of mathematical exactneſs, of ſuch 6 tones, as are called the *Diazeutic* tone, or that of *la*, *mi*, which is the difference of a fourth and fifth, but as ſufficiently exact for common uſe; for 6 ſuch tones, that is, the ratio of 9 to 8 repeated ſix times, are ſomewhat more than an octave, or the ratio of 2 to 1; and conſequently ſuch an hemi-tone is ſomewhat more than the twelfth part of an eight, or octave, or *Diapaſon*; but the difference is ſo ſmall, that the ear can hardly diſtinguiſh it; and therefore in common ſpeech it is uſual ſo to ſpeak: And accordingly, when we are directed to take the lengths for what are called the 12 hemi-tones in geometrical proportion, it is to be underſtood not to be ſo in the utmoſt ſtrictneſs, but to be accurate enough for common uſe, as for placing the frets on the neck of a viol, or other muſical inſtrument, wherein a greater exactneſs is not thought neceſſary; and this is very convenient, becauſe thus the change of the key, upon altering the place of *mi*, gives no new trouble; for this does indifferently ſerve any key, and the difference is ſo ſmall, as not to offend the ear: But ſuch as chuſe to treat of it with more exactneſs proceed thus; preſuppoſing the ratio of an octave or *Diapaſon* to be that of 2 to 1, they divide this into two ratios, not juſt equal, for that would fall on the ſurd numbers, as $\sqrt{2}$ to 1; but nearly equal, ſo as to be expreſſed in ſmall numbers; in order to which, inſtead of taking 2 to 1, they take the double of theſe numbers, *viz.* 4 to 2, which is the ſame ratio as before, and interpoſe the middle number 3; and of theſe three numbers, 4, 3, 2, that of 4 to 3 is the ratio of a fourth, or *Diateſſaron*; and that of 3 to 2, the ratio of a fifth, or *Diapente*; and theſe two, put together, make up that of an octave, or *Diapaſon*, that of 4 to 2, or 2 to 1; and the difference of theſe two, that of a tone, or 9 to 8, as will plainly appear by the ordinary method of multiplying and dividing fractions, that is, $\frac{4}{3} \times \frac{3}{2} = \frac{4}{2} = \frac{2}{1}$; and $\frac{4}{3}) \frac{2}{2} (\frac{2}{8}$: Thus in the common ſcale, or gamut, taking an octave in theſe notes *la*, *fa*, *ſol*, *la*, *mi*, *fa*, *ſol*, *la*, ſuppoſe from E to *e* (placing *mi*, *B-fa-*

B-fa-b-mi, which is called the natural ſcale) the lengths for the extremes *la*, *la*, an octave, are as 2 to 1, or 12 to 6; thoſe for *la*, *la*, (in *la*, *fa*, *ſol*, *la*) or *mi*, *la* (in *mi*, *fa*, *ſol*, *la*) a fourth, as 4 to 3, or 12 to 9, or 8 to 6; thoſe for *la*, *mi* (in *la*, *fa*, *ſol*, *la*, *mi*) or *la*, *la*, (in *la*, *mi*, *fa*, *ſol*, *la*) a fifth, as 3 to 2, or 12 to 8, or 9 to 6; thoſe for *la*, *mi*, the *Diazeutic* tone (or difference of a fourth and fifth) as 9 to 8; thus we have for theſe four notes, *la*, *la*, *mi*, *la*, their proportional lengths in the numbers, 12, 9, 8, 6: Then if we proceed in like manner to divide a fifth, or *Diapente*, *la*, *fa*, *ſol*, *la*, *mi*, or *la*, *mi*, *fa*, *ſol*, *la*, or the ratio of 3 to 2, into near equals, taking double numbers in the ſame ratio, 6 to 4, and interpoſing the middle number 5; of theſe three numbers, 6, 5, 4, that of 6 to 5, is the ratio of a leſſer third, called a *Tri-hemitone*, or tone and a half, as *la*, *fa*, (in *la*, *mi*, *fa*;) and that of 5 to 4 is the ratio of the greater third, commonly called a *Di-tone*, or two tones, as *fa*, *la* (in *fa*, *ſol*, *la*) which two put together make a fifth, as 3 to 2; that is $\frac{6}{5} \times \frac{5}{4} = \frac{6}{4} = \frac{3}{2}$, and their difference is, as 25 to 24; that is, $\frac{6}{5}) \frac{5}{4}$ ($\frac{25}{24}$; ſo we have for theſe three notes, *la*, *fa*, *la*, their proportional lengths in numbers, as 6, 5, 4: In like manner, if we divide a *Ditone*, or greater third, as *fa la*, (in *fa*, *ſol*, *la*) whoſe ratio is as 5 to 4, or 10 to 8, into two near equals, by means of a middle number 9, then we have in theſe three numbers, 10, 9, 8, that of 10 to 9, for what is called the leſſer tone; and that of 9 to 8, for what is called the greater tone: But whether *fa*, *ſol*, ſhall be made the leſſer as 10 to 9; and *ſol*, *la*, the greater, as 9 to 8; or this the leſſer, as 10 to 9, and that the greater, as 9 to 8; or ſometimes this, ſometimes that, as there is occaſion, to avoid what they call a *Schiſm*, is ſomewhat indifferent; for either way the compound will be as 5 to 4, and the difference, which is called a *Comma*, as 81 to 80; that is, $\frac{9}{8} \times \frac{10}{9} \times \frac{9}{8} = \frac{10}{8} = \frac{5}{4}$; and $\frac{10}{9}) \frac{9}{8}$ ($\frac{81}{80}$: Laſtly, if from that of the *Tri-hemi-tone*, or leſſer third, *la*, *mi*, *fa*, whoſe ratio is as 6 to 5, we take that of the tone, *la*, *mi*, which is the difference of a fourth and fifth, as 9 to 8, there remains for the *Hemi-tone*, *mi*, *fa*, or *la*, *fa*, that of 16 to 15; that is, $\frac{9}{8}) \frac{6}{5}$ ($\frac{48}{45} = \frac{16}{15}$: Or, the *Tri-hemi-tone*, or leſſer third, whoſe ratio is 6 to 5, may be divided into 3 near equals, by taking triple numbers in the ſame ratio 18, 15, and interpoſing the two intermediates 17, 16; which will therefore be as 18 to 17, and as 17 to 16, and as 16 to 15; that is, $\frac{18}{17} \times \frac{17}{16} \times \frac{16}{15} = \frac{18}{15} = \frac{6}{5}$: Where alſo the greater tone, whoſe ratio is as 9 to 8, or 18 to 16, is divided into its two near equals, commonly called *Hemi-tones*, that of 18 to 17, and that of 17 to

16;

16; that is $\frac{18}{17} \times \frac{17}{16} = \frac{18}{16} = \frac{9}{8}$: And the leſſer tone, that of 10 to 9, or 20 to 18, may be in like manner divided into that of 20 to 19, and that of 19 to 18; that is $\frac{20}{19} \times \frac{19}{18} = \frac{18}{18} = \frac{10}{9}$: Which diviſions of the greater and leſſer tones anſwer to what is wont to be deſigned by flats and ſharps: So that by this compoſition of theſe eight notes, *la, fa, ſol, la, mi, fa, ſol, la*, their ratios ſtand thus; that of *la, fa*, or *mi, fa*, is as 16 to 15; that of *fa, ſol*, as 10 to 9; and that of *ſol, la*, as 9 to 8; (or elſe that of *fa, ſol*, as 9 to 8, and that of *ſol, la*, as 10 to 9) that of *la, mi*, as 9 to 8; and if either of the tones, greater or leſſer, chance to be divided by flats or ſharps into what is called *Hemi-tones*, their ratios are to be ſuch as is already mentioned: There may be a like diviſion of a fourth, or *Diateſſaron* into two near equals; and of ſome others of theſe into three near equals; which might be of uſe for what they were wont to call the *Chromatic*, and *Enarmonic* muſick; but theſe ſpecies being long ſince laid aſide, there is now no need of theſe diviſions in our modern muſick.

Miſcellaneous Experiments; *by Sir* Rob. Southwel. Phil. Tranſ. N° 238. p. 87.

FOR red, take *Tinctura roſarum* ſix ſpoonfuls; for a deeper red, ſyrup of pomegranate flowers, one ſpoonful; either of theſe to be mixed with five ſpoonfuls of ordinary water: For violet, take one ſpoonful of ſyrup of violets to five of water; then to change the roſe colour into a deep green, take oil of tartar *per deliquium*, and with it waſh the inſide of the glaſs, leaving a few drops at bottom, and then pour in the ſaid roſe tincture, and it will change: To make the high red black, diſſolve half the quantity of a walnut of ſal armoniac in a glaſs of water, pour all out to three or four drops at bottom, if the ſaid red be put to it, it becomes as black as ink: To make the violet red, waſh the glaſs with the ſpirit of vitriol in the manner aforeſaid, and pour into it your violet water: To make red wine as yellow as ſack, ſteep braſil wood for 24 hours in white wine, or elſe in ordinary water, till it looks red, and pour the ſame into a glaſs waſhed with vinegar, it turns preſently yellow; to make this yellow white, take *Styrax Calamita*, and benjamin half an ounce of each, pulverize and ſteep this in four ounces of *Aqua Vitæ*, a few drops of this will turn the liquor white; note, this makes the *lac Virginis* for the common waſh: To make the hands and face black by waſhing them in clear water, beat galls into a very fine pow-

der,

der, and ſtrew it well, and roll it up and down into a towel, then throw ſome *Roman* vitriol into a baſon of water, which will ſoon diſſolve; and after the party has waſhed therein, as ſoon as he wipes with the towel, all the ſkin becomes black; and for ſome days waſhing it with ſoap, it will come off: To renew the luſtre of cryſtal, boil it in fair water for a quarter of an hour, and to a proportion of ſix quarts of water add one quart of brandy-wine, ſuffering the ſame to boil half an hour more, then take it out, and with the ſame liquor rub it all over throughout with a bruſh, and then dry it with a clean warm napkin, rubbing it all over, and it will regain its former luſtre: To make the hair grow, take the roots of burdock of the largeſt ſize in *December*, boil them in *French* white-wine 8 fingers high, till half is conſumed, waſh the head therewith warm at night, and it makes the hair come out, in caſe the roots be good; another, make a lee of the aſhes of vines, and waſh the head therewith warm: To prevent the ſhedding of the hair, put vine-aſhes into red *French* wine, and then filtre it, and with that liquor warm waſh the head; note, the powder of hermodactiles, uſed for the hair, as common powder, has the ſame effect: To make a fire blue, make matches of ropes not over twiſted, melt ſulphur in a pot over a charcoal fire, ſteep the matches into it three or four times at pleaſure, trace their figure on boards, then nail them thereon according to the traces of the lines, and make them a little rough by beating on them with a hammer, that the following ingredients may the better ſtick to them; after this, take ſtrong *Aqua Vitæ*, and mix with it gunpowder pulverized, to make it of a conſiſtence, and with this rub the matches with a pencil, and ſprinkle on them of the powder, then let the whole dry, and it will be fit for uſe.

The Generation of Eels; *by Mr.* Dale. Phil. Tranſ. N° 238. p. 92.

THAT the generation of any animal cannot be equivocal or ſpontaneous, but from parent animals, has been ſo well made out by many undeniable arguments, and confirmed by the ſeveral experiments of thoſe celebrated *Virtuoſi*, *Malpighi*, *Redi*, *Swammerdam*, *Leewenhoeck*, Mr. *Ray*, and others, that there is no room to doubt but eels have the ſame original; but it is much diſputed amongſt naturaliſts, whether eels have diſtinct ſexes, or whether they are hermaphrodite: Mr. *Allen* affirms the parts diſtinguiſhing the ſex to be diſcoverable, but Mr. *Leewenhoeck*

wenhoeck could never find any ſuch thing; for all thoſe he ever diſſected were provided with an *Uterus*; from hence he conjectures, that they are hermaphrodite, and beſides the *Uterus*, that they are furniſhed with male ſeed: Another controverſy about the generation of eels is, whether they are oviparous or viviparous; and tho' there are many, who firmly believe that they are oviparous, yet their ſentiments are contrary to the obſervations of Mr. *Cherwynd*, who in the month of *May* found them to be viviparous, by cutting open the red fundaments of the females, from whence the young eels would iſſue forth alive; and altho' Mr. *Allen* affirms them to be certainly viviparous, yet his obſervations concerning the place of their conception, *viz.* that they were faſtened each to very ſmall *Placentæ* affixed to the inteſtine, and that the eggs were on the outſide of the inteſtine, does not ſeem to be conſonant to that care and induſtry of nature, in providing convenient receptacles for preſerving the *Fœtus*; neither is it agreeable to reaſon to believe, that when nature hath provided an *Uterus* in all animals, not only the viviparous, but in the oviparous alſo, and inſects, the eel and *Xiphia*, or ſword-fiſh, ſhould be the only animals without it; much leſs that the guts appointed by nature for the ſecretion of nouriſhment, and the expulſion of the *Fæces*, and which are always in motion, ſhould be the place of generation in any animals; on the contrary that the eel hath an *Uterus*, is aſſerted by Mr. *Leewenhoeck*, who never found them without one; which perhaps is that part, Mr. *Allen* names a ſlender gland, lying tranſverſely near the bowel: Beſides, nature having furniſhed all animals hitherto diſſected not only with an *Uterus*, but alſo with *Tubæ*, firſt obſerved by *Fallopius*, for conveying the *Ovum* from the *Ovarium* to the *Uterus*, this is another great objection againſt Mr. *Allen*'s obſervations, in which indeed he ſeems to contradict himſelf; for whereas he ſaith, that in one eel he found eggs, and thoſe on the outſide of the inteſtine, but in another ſix young ones, each faſtened to a ſmall *Placenta*, and thoſe within the inteſtine; how and by what paſſages could thoſe eggs come into the great inteſtine, to be formed and invigorated? Unleſs we may ſuppoſe, that like the *Embryos* of ſome ſorts of inſects, they eat their way, for the conveniency of food, into the heterogeneous or aſſumed *Matrices*.

The Diſſection of an Opoſſum; *by Dr.* Tyſon. Phil. Tranſ. N° 239. p. 105.

THIS animal, which was brought alive from *Virginia*, has many names given it by different authors, and generally by the *Engliſh* it is called *Opoſſum*, or *Poſſum*; in *Latin* it is named, *Semi-vulpes*, and *Vulpi-ſimia*, as if it were of a middle nature, between a fox and an ape; but Dr. *Tyſon* is of opinion, that a denomination might be beſt given it, from that particular, wherein it is moſt diſtinguiſhable from all other animals, which is that remarkable *Marſupium*, or pouch, it has in its belly, into which, upon any occaſion of danger, it can receive its young; whence it may properly be denominated, *Marſupiale Americanum*; and Dr. *Tyſon* thinks it may be reduced to the vermin-kind: It meaſured from the extremity of the noſe to the tip of the tail, thirty one inches; the length of the head was ſix inches, the tail was a foot in length, the compaſs of the body was fifteen inches and a half when dead; when alive and well it ſeemed much thicker; the fore-legs were ſix inches long, the hinder-legs only four inches and a half; the compaſs of the tail, near the root, was three inches, near the tip, only one inch; about the ears the head was largeſt, meaſuring on the forehead from one ear to the other, three inches; thence gradually tapering towards the noſe, and more reſembling that of a pig, than a fox; the apertures of the eye-lids were not horizontal, but lying in a ſtreight line from the eyes to the noſe, and but ſmall; the ears were about an inch and a half long, not ſharp, but of a roundiſh figure; the *Rictus* of the mouth, from one corner to the extremity of the noſe, meaſured two inches and a half; the fore-feet had five long claws or fingers, equally ranged with each other, and a hooked nail at the end of each finger; the hinder feet had four fingers armed with hooked nails, and a perfect thumb, ſet off at a diſtance from the range of the other fingers, and as in a human body, this thumb was ſhorter than the other fingers, and had not a hooked prominent nail, but a tender flat one; this contrivance of the legs, feet, and nails ſeem very advantageous to this animal in climbing up trees, which it does very nimbly in queſt of birds, a prey it is very fond of, tho' it alſo feeds on other things; theſe fingers, toes, and claws were naked, and without hair, the ſkin here ſhewing of a reddiſh colour; they were about an inch long, and the thumbs were almoſt of the ſame length; the palms, eſpecially if dilated, which it does in climbing, were large, but ſo contrived, as to be capable of

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contraction, as it does in walking; but that they might be better defended from injury, at the ſetting on of each toe, there is in the palms a protuberant, fleſhy, and almoſt cartilaginous body; in feeding it makes uſe of the fore-feet to bring the food to its mouth, as the monkey and ſquirrel-kind do; the tail was without hair, except for a little way near the ſetting on, and tapering from the root towards the tip, it was covered with a regular order of ſmall whitiſh ſcales, which for the moſt part were oblong hexagons; between each there was obſervable a ſmall ſkin or membrane, in which they are fixed; the colour of the ſcales makes the tail appear whitiſh, tho' the ſkin ſeem of a darker colour; the ears were alſo bare and without hair; and tho' ſoft and ſlender, and in colour and ſubſtance almoſt reſembling the membrane of a bat's wing, yet they are erect, and of an oval figure: Dr. *Tyſon* could not perceive that cartilaginous body, which is uſually to be met with in the ſtructure of this part; ſo that if it had any, it was at leaſt much finer than in moſt other animals; the *Concha*, or paſſage to the *Porus auditorius*, was very capacious; but it was obſerved, that when our ſubject began to grow ill, the verge or rim of the external ear ſeemed to be crimpled; and when dead, it was ſhrivelled up in ſuch a manner, as if burnt, not forming a ſmooth but a jagged edge: The upper jaw was ſomewhat longer than the under; the noſtrils were large; the eyes black, ſmall, vivid, and exerted when alive, and very much ſunk, when dead: The neck was ſhort, and the breaſt broad; it had muſtacio's like a cat; the fur upon the fan was ſhorter and whiter than the reſt of the body; on the back and ſides it was of an aſh-colour, or dappled with black hairs in ſpots, intermixed with white, eſpecially on the back; on the belly it was more of an amber colour, and of a darker colour on the legs; the longeſt hairs, which were ſtronger and coarſer than the reſt, meaſured three inches, they were white towards the ends; but perhaps the furr may vary in different ſubjects: At the bottom of the belly, in the middle between the two hinder legs is obſerved a ſlit or aperture, moderately extended, about 2 inches long, but capable of a greater extenſion, by dilating it with the fingers, even when alive; the animal can ſo exactly cloſe and contract it, that the eye does not readily diſcover it; there is on each ſide of this aperture a reduplication of the ſkin inwards, which forms a hairy bag; but the hairs here are ſo thinly ſet, that almoſt every where you may obſerve the ſkin: All authors agree, that the uſe of this bag, pouch, or *Marſupium*, is to preſerve its young, and ſecure them againſt any danger; and the

contrivance of nature is admirable in forming and adapting this part ſo ſuitably to that end; for there are two remarkable ſtrong bones, not to be met with in any other ſkeleton, which from their office Dr. *Tyſon* calls *Oſſa Marſupialia*, or *Janitores Marſupii*; theſe bones are ſo faſtened to the upper and internal edge of the *Oſſa pubis*, that at their baſis here they touched each, juſt at the coalition of the bones, that form the *Oſſa Pubis*; the other extremities of theſe bones were ſo diſtant from one another, as to meaſure 2 ½ inches; the baſis of theſe bones, where joined to the *Oſſa Pubis*, was half an inch broad, having two heads, the larger lying near the coalition of the *Oſſa Pubis*, and the leſſer towards the *Os Coxendicis*, having in the middle a *Sinus*, into which was received a protuberance of the *Oſſa Pubis*; by this contrivance it appears, that there can be no motion of theſe bones, nearer or farther from each other, but that they muſt ſtand always at an equal diſtance, but they were obſerved capable of a ſmall motion inwards, towards the ſpine, and outwards from it; theſe bones, as they aſcended from the *Os Pubis* grew more ſlender, being about the middle but a quarter of an inch broad, and each two inches long; theſe bones were furniſhed with four pair of muſcles, and another pair run over them, to which they performed the office of a *Trochlea*, or pulley: The firſt pair of muſcles, that is, which came firſt to be diſſected, upon the pronation of the animal, and which from their figure Dr. *Tyſon* calls *triangularis*, ariſes fleſhy from the whole length of the internal ſide of theſe bones, and inſerted their oppoſite tendons on each ſide of the *Rima*, or aperture of the *Marſupium*; under part of theſe muſcles lay another, or a ſecond pair, flat and thin, having their origin from the upper part of the internal ſide of the *Oſſa Marſupialia*, and inſerting their oppoſite tendons a little above the tendons of the former muſcles; the tendency or direction of the muſcular fibres of this pair, in reſpect of the firſt, made a decuſſation; the third pair of muſcles had their riſe from the fore-part of the baſis of theſe bones, where they were joined to the *Os Pubis*, and were afterwards inſerted into the *Linea aſpera* of the thigh-bone; the fourth pair aroſe from the external ſide of theſe bones near the baſis, and were inſerted into the fore part of the thigh-bone near the middle; the laſt pair of muſcles ariſe more immediately from the *Marſupium*, or pouch itſelf; for ſpreading their muſcular fibres all over this bag, as they iſſue from it, by joining their fibres together, they more remarkably form a ſolid muſcle, which paſſing on each ſide over the middle of theſe bones, that is in the prone poſture of diſſecting the

the animal, they at length were inſerted into the ſpine of the *Os Ilium*; the two firſt of theſe muſcles muſt ſerve for the dilatation or opening of this *Marſupium* or pouch; for theſe bones are a fulciment or baſis, their articulation not admitting of a contraction inwards, or nearer to each other; wherefore, when the firſt and ſecond pair of muſcles act, they muſt neceſſarily open or dilate the mouth of the *Marſupium* or pouch; the third and fourth pair may ſerve to extend theſe bones outwards; ſo that when this animal hangs by its tail, as it frequently does, the weight of the *Fœtus* in this pouch, by this means will not preſs ſo much upon the internal *Viſcera*; the fifth and laſt pair, as they may ſerve to dilate the capacity of the pouch itſelf, ſo likewiſe the better to ſuſpend its weight, when the animal is *prono Capite*, and if it gravitates too much, they may retract it upwards, and this the eaſier, as paſſing over theſe bones like a pulley, their force is more augmented: The antagoniſt to theſe muſcles is the *Sphincter Marſupii*, an oval ſeries of ſtrong fleſhy fibres, which ſerve to conſtringe and cloſe the orifice of the pouch, which it does ſo perfectly, that one would think the ſkin here was not ſlit: The *Marſupium*, or pouch itſelf, was a membranous body, not very thick, tho' conſiſting of ſeveral coats; and it is reducible into the claſs of the veſicular parts of the body; which, according to Dr. *Tyſon*, are partly muſcles, partly glands, and perform both the office of motion and ſecretion; for the cavity of this pouch was ſomewhat hairy, and in ſeveral places the hairs were obſerved to be matted together by a yellowiſh ſubſtance, which ouſed out of the cutaneous glands; this liquor, diſcharged into the pouch from the glandulous coat, was ſtrong-ſcented, and had more of the peculiar *Fœtor* of this animal than any part beſides; but after the ſkin, together with the pouch, had been kept for ſome days, and was grown dry, there was ſo great an alteration in the ſmell, that what before was ſo diſagreeable, was now become a perfect perfume, and ſmelled altogether like muſk; this *Marſupium* had likewiſe a muſcular coat, beſides the ſeveral other muſcles beſtowed upon it to give it motion, as was already obſerved; it had alſo a vaſcular coat, being plentifully irrigated by blood-veſſels, eſpecially by two large branches, that came from the upper part of the *Thorax*, and which might be reckoned the *Mammaria*, as they are ſtiled in other animals; this pouch was faſtened by ſeveral membranes to the muſcles of the *Abdomen* and the ſkin, but ſo as to be eaſily ſeparated for the moſt part with the fingers; in this pouch

pouch moſt authors place the *Mammæ*, or teats, but Dr. *Tyſon* could find none in this place, nor even on the outward ſkin, as is uſual in other multiparous animals; poſſibly this ſubject never had a litter, ſo for want of drawing, the teats might be leſs, ſo as to eſcape notice; the male alſo, if we may believe *Piſo*, has ſuch another purſe under his belly, and takes his turn to carry the young, in order to eaſe the female: This contrivance of nature, for ſecuring the young from any danger, till they are able to ſhift for themſelves, is not to be parallel'd in any ſpecies of animals, at leaſt of the quadruped kind, beſides: In the *Thorax* of the *Poſſum*, the lungs had three lobes on one ſide, and only one on the other, but this was as large as the other three; they were ſoft and ſpungy, eaſily dilated, and large in proportion to the animal: The heart was included in a *Pericardium*, as uſual, but larger, in reſpect of the bulk of the animal, than is common; nor was its cone ſo ſharp, but rather more obtuſe; it had two auricles and two ventricles: About the throat there were large *Glandulæ Maxillares*; the tongue was little more than 3 inches long, and above $\frac{3}{4}$ of an inch broad, it was rough with protuberances, whoſe points looked inwards; the voice, or noiſe it made, was a little growling: The *Abdomen*, or belly, was divided from the *Thorax*, or breaſt, by a large, ſtrong, fleſhy diaphragm; for the compaſs of the *Thorax* in this place was very great and large, which might be rendred ſo the more, becauſe the animal often hangs by its tail, whereby the *Viſcera* of the *Abdomen* muſt preſs upon it: The ventricle, or ſtomach, reſembled a little the figure of a half-moon; but the two orifices of the *Gula* and *Pylorus* were placed ſo near each other, that they ſeemed to touch or meet; and when the ſtomach was opened, there was only a very ſlender *Iſthmus*, or wall, that parted them; theſe orifices were inſerted almoſt in the middle of the upper part, but more inclining towards that which reſpects the *Duodenum*; the ſtomach appeared but ſmall, being much contracted, for the animal had not eaten any thing for ſome days; it meaſured about three inches and a half in length, and about two inches in depth: The *Gula*, which conveys the food into the ſtomach, conſiſted of ſtrong muſcular fibres, and was about nine inches in length; the *Pylorus* ſeemed to have its paſſage free and open, without that annular conſtriction, or valve, as in moſt other animals, tho' there was here obſerved a larger body of muſcular fibres than in other inteſtines: There was nothing contained in the ſtomach, but a body of clotted hair,

hair, formed into the ſhape and figure of the ſtomach, ſomewhat like an half-moon, covered with a ſlimy, inſipid ſubſtance, which ſerved the better to glue theſe hairs together; ſuch hairy *Tophi* are frequently to be met with in the ſtomachs of oxen; and butchers obſerve, that they chiefly meet with them in the winter-ſeaſon, after the hair begins to ſhed, and the cattle feed upon hay, or dry meat; but after the ſpring, and in ſummer, they more rarely find them, as if the new graſs, which purges them, did contribute to diſſolve theſe *Tophi* likewiſe: But our animal is carnivorous, and moſt rapacious of the winged kind, and where it cannot find its prey on the land, it will hunt for it in the trees, climbing up them very nimbly; and if the tender bough cannot bear the weight of its body, by twiſting its tail about the twig, it can hang thereby, and ſtretch itſelf the farther, to obtain its deſired food, or rob a neſt; nay, even by this means it can fly, or paſs from one tree to another; for hanging thus by the tail, and waving and ſwinging its body like a *Pendulum*, it can fling itſelf into the boughs of a neighbouring tree, where its tail is ſure to take faſt hold of the firſt bough it lights on, if otherwiſe it miſſes its footing, and his hinder feet being made like hands, and furniſhed with a thumb, it can the more readily raiſe its body up by them; but tho' theſe animals are carnivorous, yet when need drives them, they can take up with other food; for this ſubject would eat any thing brought him from the table: The *Meſentery* is that membranous part, which binds the inteſtines together, and fixes their ſituation, and gives them the order of their figure; the inteſtines are not juſt faſtened to the periphery, or outward circumference of the *Meſentery*, but its external membrane on both ſides is entirely projected, and continued over the whole canal, or duct of the guts, and forms their external or common membrane; ſo that often, by ſeparating this external membrane from the muſcular one that lies under it, the length of the guts may be extracted, leaving only the common membrane, as it is continued from that of the *Meſentery*, which would be inflated, as if the guts remained there entire; now here is obſervable, that remarkable difference from many other animals, that we cannot but make two *Meſenteries*; one peculiar to the ſmall guts, the other to the great ones; the former Dr. *Tyſon* calls *Meſenterium minorum*, and the latter, *Meſenterium majorum Inteſtinorum*; for as the *Duodenum* deſcended from the ſtomach, it ran under the *Colon*, juſt where it is joined to the *Cæcum*, towards the middle of the

ſpine;

ſpine; from this place he found a projection of the firſt *Meſentery* into a ſpiral line, like a *Cochlea*, or winding pair of ſtairs; ſo that upon inflation, theſe inteſtines made ſeveral convolutions, tho' not exactly ſpiral; the ſecond *Meſentery* was projected more into a plane, and made almoſt a circular figure at its periphery; ſo that the *Cæcum* and *Colon* did almoſt entirely encircle the ſmall guts: The reverſe of this ſtructure of the inteſtines, Dr. *Tyſon* formerly found in the diſſection of the *Tajacu*; for there the *Colon* made a ſpiral figure, and the ſmall guts a plane one; but this ſpiral convolution of the inteſtines, is alſo to be met with in ſeveral other animals, tho' their ſtructure be different, as in the goat and deer-kind, and very remarkably in a woodcock: The ſmall guts meaſured about ſix foot and a half in length; the *Cæcum* was about ſix inches, and the *Colon* and *Rectum* were about two foot long; the compaſs of the *Duodenum*, (which is to be underſtood all along here as inflated) was 3 inches; the *Ilion* was 2 ½ inches; the compaſs of the *Cæcum* in the largeſt place was 6 inches; and the *Colon*, 4 inches; the *Rectum* was 3 inches about from the ſpine to the utmoſt projection of the ſmall guts (under the ſame circumſtance of inflation) meaſured about 6 inches the greateſt diameter of the *Colon* in this circular figure, was ſomewhat above 7 inches; in the whole duct of the inteſtines there were no valves obſervable, not even in the *Cæcum* itſelf; it is true, that the *Foramen* into the *Cæcum* was a great deal leſs than the capacity of the gut itſelf; however, the paſſage into it was ſo open and wide, as readily to receive or emit its contents; but the length, and frequent gyrations and windings of the inteſtines ſupply this want of valves; they prevent the danger of a too haſty deſcent of the *Fæces*, and give a greater opportunity for the ſeparation of the chyle into the *Vaſa chylifera*; and the *Cochlea*, or ſpiral figure of the firſt *Meſentery* eaſily prevents the regurgitation of the contents of the inteſtines again into the ſtomach, upon a declining poſture of the body of this animal, in which it frequently is, when it hangs by the tail; for tho', as was obſerved, the paſſage from the ſtomach by the *Pylorus* into the *Duodenum* is large and open, yet in that poſture of the body there cannot but be a reduplication, or folding over of the *Duodenum*; ſince the great bulk of the inteſtines muſt incline towards the *Diaphragm*, by which reduplication, the paſſage at the *Pylorus* muſt, in a great meaſure, be obſtructed, and the aſcent of the contents muſt now be as difficult and great, as when the animal ſtands upon its fore-

feet:

feet: The *Pancreas* was large, with one part running towards the ſpleen, and the other down along the *Duodenum:* The liver was very large, of a bright red colour, and conſiſting of three lobes, two of which were much larger than the third, which was not to be ſeen, but upon inverting the liver; and here were found, not only at the edges of one of the larger lobes, deep inciſures, which rendred it jagged; but alſo in the middle of the concave part of the ſame lobe, there were ſeveral deep fiſſures; the reaſon of this ſtructure may poſſibly be, that ſo it may yield, and give way the better, when it is inverted, as it always is, when this animal hangs by its tail: The gall-bladder was very large; the kidneys on each ſide were a little more than an inch and a half in length, about $\frac{3}{4}$ of an inch broad, and of the figure almoſt of a kidney-bean; the emulgent veins and arteries were very plainly ſeen; on the inſide of the kidneys; towards the upper part, were placed the *Glandulæ renales*, which were very large, and of the ſame colour with the kidneys themſelves, which was a deep red: The *Ureters* were about 5 $\frac{1}{2}$ inches long, and were inſerted into the neck of the bladder of urine, firſt running under, then aſcending up by the two extremities of each *Uterus*, as they lie duplicated; the bladder of urine, when inflated, was about the bigneſs of a hen's egg, and of that figure; the neck of the bladder or *Urethra*, which was about an inch long, lay over the *Vagina Uteri*; and here the *Urethra*, and *Vagina Uteri*, emptied themſelves into one common canal, which meaſured about an inch and a half in length; in moſt animals, about the kidneys, there is uſually obſerved a large body of fat, which covers them, and it is contained in the *Membrana adipoſa*; but in this ſubject there were found four large protuberances of fat, two on each ſide; two of them lay in the *Pelvis* of the *Abdomen*, near the bladder of urine and the uterine parts; and the two others lay between them and the kidneys; they conſiſted of large regular *Laminæ*, which were eaſily ſeparable from each other, in broad flakes in an uncommon manner: Amongſt the uterine parts, which were very ſurpriſing, there were found two *Ovaria*, two *Tubæ Fallopianæ*, two *Cornua Uteri*, two *Uteri*, and two *Vaginæ Uteri*; the *Ovaria* were placed, one on each ſide, near the extremities of the *Cornua Uteri*, being faſtened to the *Alæ Uteri*, and were about the bigneſs of a vetch; the *Vaſa præparantia* were very plain, tho' the greateſt part of theſe veſſels was beſtowed on the *Cornua Uteri*; near the *Ovaria* was obſerved the *Fimbria*

Foliacea, and from thence a paſſage into the *Tuba Fallopiana*; the *Tubæ Fallopianæ* were two fine ſlender canals or ducts, ſupported by the *Alæ Uteri*, and running waving, and leading into the extremities of the *Cornua Uteri*; the *Cornua Uteri* being inflated, were about the bigneſs of a gooſe-quill, near an inch and a half long, and were faſtened to the *Alæ Uteri*, towards both ends a little bent; but where they paſſed into the *Uteri*, they were reflected inwards, and at the other extremity reflected outwards; their ſubſtance ſeemed rather thicker than the *Uteri* themſelves, and not ſo tranſparent, by reaſon of the numerous blood-veſſels, which irrigated them almoſt all over; for on the inſide, both above and under, there ran the whole length of the *Cornua*, large trunks of blood-veſſels, ſending from the ſides all along numerous branches; which is very requiſite in animals that are multiparous, as in our ſubject, having five or ſix young at a time, which lie and are formed in the *Cornua Uteri*; and here Dr. *Tyſon* obſerved ſome ſmall eminences on the internal membrane of the *Cornua*, whereby they were ſomewhat divided into cells, but very imperfectly; the two *Cornua* empty themſelves into the two *Uteri*, juſt in the middle, where they are conjoined together, and ſo outwardly ſeem to form, as it were, one continued body: In the females of lobſters and crabs there are two *Uteri*, as there are two *Penes* in the male; ſo there are two *Penes*, and each of them forked, in the rattle-ſnake; but this ſeems to be the only inſtance of a land quadruped, that hath two *Uteri*; and each of them double by the reflection they make, and by an imperfect *Diaphragm*, which divides the cavity of each *Uterus* a conſiderable way: Theſe *Uteri* are not faſtened to the *Alæ*, as the *Ovaria*, *Tubæ*, and *Cornua* are; but where they are conjoined, near the inſertion of the *Cornua*, they adhere very firmly to the neck of the bladder, and hardly ſeparable therefrom; and by a membrane, to the *Rectum*, where they are more eaſily ſeparable; ſo that the neck of the bladder lies over the *Diaphragm*, or membrane, which divides them, as was ſaid, into two diſtinct *Uteri*; here the body of the *Uteri*, inflated, meaſured in compaſs, about an inch and three quarters; from hence they were projected towards each ſide, and not according to the length of the ſpine, gradually enlarging the internal cavity, as it is extended; for here, about the angle of reflection, it meaſured in compaſs, two inches and a half; the *Uteri*, being thus extended towards each ſide, about the ſpace of an inch and three quarters, are then reflected back again

again towards the neck of the bladder, and ſo paſs into the two *Vaginæ*, which lie under the *Urethra*; from this angle of reflection, the cavity of each *Uterus* gradually leſſens, and is much ſmaller than the other parts of the *Uterus*, the capacity of each *Uterus* being the largeſt at the external bending, where it begins to be reflected; for here it was made, as it were, one common cavity for almoſt the length of an inch; but on the inſide, there was a membrane projected from the internal ſide of the *Uteri*, juſt from the corner, where the ſides of the *Uteri* are doubled, whereby this cavity is in part divided; and for this reaſon, the membrane may be called the ſecond, or an imperfect *Diaphragm* of the *Uteri:* In theſe *Uteri*, Dr. *Tyſon* obſerved four large trunks of blood-veſſels, which ran their whole length, ſending from their ſides numerous branches and ramifications all along; theſe trunks were propagated from the hypogaſtric and ſpermatic veſſels; he alſo obſerved here in theſe *Uteri*, extended by inflation and dried, ſeveral *Faſciculi* of muſcular fibres, placed at a regular diſtance from each other, and which likewiſe ran the whole length of the *Uteri*, by whoſe contraction the *Fœtus* may be more eaſily protruded: The two *Uteri* empty themſelves into the two *Vaginæ*; for at this extremity, the *Uteri*, making a turn at the neck of the bladder, are continued thence into the two *Vaginæ*, which lie juſt under the *Urethra*, and are much of the ſame length therewith, which was about an inch; their capacity was about the bigneſs of a wheat-ſtraw; both theſe *Vaginæ* and the *Urethra* too, emptied themſelves into a common paſſage, which was as large as all the other three, and about an inch and a half in length; it ſhewed reddiſh, by means of its numerous blood-veſſels, and at laſt had its exit ſo near the fundament, that, when alive, no other *Foramen* was obſerved externally, but that which led into the *Rectum*; but upon diſſection, by elevating the ſkin here, which ſeemed to cover it like a valve, Dr. *Tyſon* obſerved the *Foramen*, that led into this common paſſage, and putting a blow-pipe into it, he at the ſame time inflated the bladder of urine, and the uterine parts too; *viz.* the *Vagina*, the *Uteri*, and the *Cornua*; ſo that in the ſkin here, there was only one *Foramen* for the *Fæces*, the urine, and the *Fœtus*.

The ſkeleton of the head, from the end of the *Occiput* to the extremity of the *Nares*, was four inches and three quarters long, of which the *Roſtrum*, or ſnout, meaſured three inches, and juſt where the ſnout and *Cranium* met, the bones were ſo pinched in at the ſides, that here it was very narrow; and it

may be ſaid, that in proportion to the bulk of the animal, this is the leaſt *Cranium* to be met with in any quadruped; on the forehead, the ſnout was an inch broad, having on each ſide a protuberance jutting out; there was a large future, exactly in the middle; which divided the upper bones of the *Nares* length-wiſe, and tho' they run ſlender towards the extremity of the *Nares*, yet theſe bones, towards the forehead, ſpread into a triangular figure, and as they are jointed together, form a rhomboid, or lozenge; there was a remarkable ridge, like a creſt, that ran the length of the *Cranium*, from the forehead to the *Occiput*, exactly in the middle, where the *Sutura Sagittalis* is in other ſculls; this ridge, for diſtinction-ſake, Dr. *Tyſon* calls *Protuberantia Oſſea Longitudinalis*, and he obſerved it to jut out from the *Cranium* above a quarter of an inch; juſt at its upper edge, he could perceive a ſcum like a future; ſo that, tho' theſe bones are ſo well united, as to appear but one entire body, yet in the *Fœtus*, without doubt, they are ſeparable, and are two; and this he thinks the rather, as in the upper part of the *Cranium* he could not find any futures at all; ſo likewiſe, thoſe other ridges in the extremity of the *Occiput*, which he calls *Protuberantiæ Oſſeæ Laterales*, anſwer to the lumbdoidal futures; and theſe protuberances ariſing on each ſide from the *Proceſſus Styloides* aſcend obliquely up the hinder part of the *Occiput*, and juſt in the middle at the top are joined with the longitudinal ridge; theſe ridges, tho' as deep as the firſt, yet they did not ſtand ſo upright, but projected rather like a pent-houſe over this hinder part of the *Cranium*; by both which ridges, the *Cranium* is ſo well guarded and defended, that it is almoſt impoſſible that the ſcull ſhould be any ways cracked or broken; ſomething like theſe ridges, but nothing ſo large, he obſerved in the ſcull of a weaſel: The eyes were alſo well defended by the *Os Zygomaticum*, which is very broad and ſtrong, being in the broadeſt place above $\frac{3}{4}$ of an inch, and in the narroweſt half an inch, very thick on its under edge, but at its upper growing thin and ſharp; but for ſtrengthening this bone, which is formed by a proceſs from the *Os Temporum*, and another from the *Maxilla inferior*, where theſe meet, they lap over each other, and ſo become the ſtronger; this *Os Zygomaticum* was two inches and a half long, and projecting from the *Cranium* an inch; in the orbit of the eye; at the internal *Canthus*, there was a large *Foramen*, which led into the cavity of the noſe, and by a duct placed here, the tears,

or

or moiſture, from the eyes, are conveyed into the noſtrils; there was alſo a large *Foramen* in the upper jaw-bone, for the paſſage of ſome veſſels from the internal orbit of the eye: The *Cranium*, which encompaſſed the brain, was in the largeſt place about an inch over, and about an inch and a half in length, but its cavity jutted out ſomewhat farther towards the *Nares*, forming as it were, a particular cell here, and pretty capacious, for receiving the *Proceſſus Mammillares*, and the fore-part of the brain; the *Os Cribriforme* was very remarkably perforated with holes like a ſieve; and indeed, in forming this organ of ſmelling, nature ſeems very careful and ſolicitous, the *Roſtrum* making ſo great a part of the head, that the *Cranium* itſelf ſeemed very inconſiderable in reſpect thereof, its internal capacity containing not above the quantity of a walnut; the *Os Spongioſum* in each noſtril ſeemed very curiouſly contrived by it's number of *Laminæ*, ſo that the membrane, which covers them, is by this means rendred more capacious, and capable of receiving more plentifully the *Effluvia* of thoſe animals, it would either catch or avoid; and it is known that brutes in this ſenſe excel even man himſelf, and that their organ is more adapted to it: The under jaw conſiſts of two ſtrong bones, joined together only at the *Mentum*, or chin, each of them meaſured four inches in length; the head of this bone, which was half an inch broad, was received into a *Sinus* of the *Os Temporum*, and very firmly articulated there; it had two *Proceſſus*; the anterior or ſuperior is large and thin, into which the temporal muſcle is inſerted; the inferior proceſs is ſmaller, and runs to a ſharp point; here at this proceſs, the edge of the mandible is ſo dilated, that it meaſured above half an inch; on the inſide of the jaw is a large *Sinus*, which leads to a *Foramen*, that goes into the body of the jaw-bone, and affords a paſſage for the veſſels thither; in the upper jaw there were anteriorly eight ſmall *Dentes Inciſores*, four on each ſide, then a void ſpace of a quarter of an inch, and then two large prominent *Dentes Canini*, one of each ſide, which jutted out of the jaw about half an inch; theſe were ſucceeded on each ſide with three *Dentes Inciſores*, which were much ſtronger and larger than the fore-teeth, and reſembled the *Dentes Molares*, they were flat and almoſt of a triangular figure; there were four *Dentes Molares* on each ſide, and in all 24 teeth in the upper jaw; but the double fangs of the *Molares* and the larger *Inciſores*, were ſuch as at firſt ſight appeared to be two diſtinct teeth, each fang being inſerted into a diſtinct *Alveolus*, or ſocket, and ſeparated for ſome way above the jaw-bone, and only joined

joined at the head; in the under jaw, there were likewiſe on each ſide, four ſmaller *Inciſores* before, then a ſmall void ſpace, after that the *Dens Caninus*, then three larger *Inciſores*, and laſt of all four *Dentes Molares*, anſwerable to thoſe in the upper jaw, but ſomewhat ſmaller; in all 48 teeth in both jaws: There were ſeven *Vertebræ* of the neck, 13 of the back or *Thorax*, 6 of the loins, 3 of the *Os Sacrum*, and 22 of the tail, in all 51; the firſt *Vertebra* of the neck, to which the head is faſtened, and therefore called the *Atlas*, had two broad tranſverſe proceſſes, but no ſpine; the ſecond *Vertebra* of the neck had a very large and thick ſpine of a triangular figure; and in it was obſerved a larger ſemicircular *Sinus*, which was ſo deep as to receive into its cavity a great part of the firſt *Vertebra*, by which means the articulation was very much ſtrengthened; this *Vertebra* is called *dentata*, from its tooth-like protuberance, received into the hollow of the firſt *Vertebra*, where the *Medulla Spinalis* paſſes; this *Vertebra* had backwards two *Proceſſus obliqui ſuperiores*, and two *Obliqui inferiores*; the third *Vertebra* of the neck had the ſame proceſſes both before and behind, but the ſpine here was about $\frac{3}{4}$ of an inch in height, and about the third part of an inch thick; and juſt at the top ſeemed to be a little cleft; the fourth and fifth *Vertebæ* had the ſame proceſſes, as the third, and the ſpine here likewiſe was very thick, and cleft to the top, but gradually leſſening in height, as alſo thickening; the ſixth *Vertebra*, beſides the former proceſſes, had likewiſe an acute tranſverſe one on each ſide, and its ſpine was much ſhorter, and more acuminated than the former; the ſeventh *Vertebra* of the neck had only oblique proceſſes before and none behind, and two acute tranſverſe proceſſes, and a very ſhort and ſharp ſpine; ſo that upon holding up the head the ſpine of the firſt *Vertebra* of the *Thorax* would touch the top of the fifth *Vertebra* of the neck; theſe *Vertebræ* are ſo ſtrongly and cloſely locked into each other, that tho' each of them is large in itſelf, yet thus articulated, they do not make full two inches in length; this thickneſs and ſtrength of the *Vertebræ* of the neck, and likewiſe of ſeveral of the *Vertebræ* of the *Thorax* and loins, and the prominent bony ridge in the *Cranium*, do ſo well ſecure its neck, back, and head, that ſhould it happen to fall to the ground, there would be no danger of breaking any of them: The firſt ſeven *Vertebræ* of the *Thorax* have three oblique proceſſes forwards, which run under the hinder oblique proceſſes of the preceeding *Vertebra*, and have two oblique proceſſes backwards, which ride over thoſe of the ſucceeding *Vertebra*; as likewiſe

two

two transverse processes, which at their extremities have small *Acetabula* or *Sinus*'s, for the receiving the heads of the ribs, which are fastened to them; the spines of these *Vertebræ* are slender thin, and sharp, about $\frac{3}{4}$ of an inch long; the six following *Vertebræ* of the *Thorax* have short, thick, and flat spines, the oblique processes, being continued on each side of the spine, make, as it were, a gutter; and the transverse processes here are somewhat different from the former; the spines of the *Vertebræ* of the back, or loins, as they approached the *Os Sacrum*, so they gradually lessened in their thickness on the edge; but here there were double oblique processes; *viz.* four at each end of the *Vertebra*, the undermost spreading themselves out in breadth; the three *Vertebræ* of the *Os Sacrum* are firmly fastened to the *Os Ilium*, but the last not so entirely as the two former, which at each side had a broad transverse process, and the spines of the two former were thin; the two first *Vertebræ* of the tail had only one small acute spine, but in all the other *Vertebræ* of the tail, both at the head and tail of each *Vertebra*, there were two spines, but those at the head of the joint were the largest; in the six first *Vertebræ* of the tail, there was on each side, a broad transverse process, the length of the joint; in the other *Vertebræ*, only at the head and tail, a jutting out at the sides; the *Vertebræ* about the middle of the tail were the longest, being there about an inch in length, but at the root and end of the tail not so long: The spines or hooks, placed in a line in the middle of the under side of the *Vertebræ* of the tail, are a wonderful piece of mechanism; it is true, the first three *Vertebræ* had none of these spines, but in all the rest they were to be observed; and as they approached the extremity of the tail, they grew lesser and shorter; these spines, where longest, were about a quarter of an inch, or somewhat more; they were placed just at the articulation of each joint, and in the middle from the sides, and seemed to be articulated, both to the preceeding and following *Vertebræ*, not being an entire solid bone, but arising from the *Vertebræ* with two *Crura* or legs, were become afterwards perfectly united to the extremities; by this means the bones are rendred more strong and firm, and this hollow serves for the transmitting the blood-vessels thro' them; and one may here observe a *Stria* or furrow, all the length of the *Vertebræ*, for the receiving them, whereby they are the better secured from compression, when this animal hangs by its tail; and for the performing this office, nothing could be more advantageously contrived; for when the tail is twisted or wound about a stick, this hook of the spine easily

sustains

ſuſtains the weight, and there is but little labour of the muſcles required, only what is ſufficient to bend the tail; for then, as by a hook, the weight of the whole body is hereby ſuſpended; and for the performing this, it was obſerved, that in each preceeding *Vertebra* there aroſe a muſcle, which was inſerted on each ſide of the ſucceeding *Vertebra*; which, upon its acting, muſt neceſſarily bend that joint; but for the ſtrengthening the whole, there were obſerved four muſcles to ariſe from the *Os Sacrum*, which ran the whole length of the tail, two on the upper ſide, and two on the under, ſending each a tendon to each internode, or *Vertebra*; ſo that when the ſkin was ſtripped off, the external parts of theſe muſcles ſeemed to have tendinous expanſions over them, the whole length of the tail, and to be almoſt covered by them, which muſt needs very much contribute to add ſtrength to the tail, beſides what may be the effect of their inſerting of tendons into each joint or *Vertebra* in bending the tail: The ribs are faſtened to the *Vertebræ* of the *Thorax*, and there are 13 on each ſide; the ſeven foremoſt are more perfectly articulated with the *Sternum*, the ſix ſucceeding may, in ſome meaſure, be reckoned *Coſtæ Nothæ*; for tho' they are long, and as they proceed from the *Vertebræ*, inclined backwards towards the hinder legs, yet afterwards they are reflected forwards towards the *Sternum*, or *Cartilago Enſiformis*; and tho' in other animals, that part of the ribs, which is faſtened to the *Os Pectoris*, or *Sternum* be uſually cartilaginous, yet in this ſubject it was obſerved to be all bony throughout; there was however this difference, that the ribs looked redder, by reaſon of their blood-veſſels, and this part was whiter, as one might plainly ſee where it was faſtened to the ribs; ſo that it may well paſs for a bony cartilage, as often cartilages become bony: The firſt rib was only an inch in length, and its bony cartilage a quarter of an inch; hence gradually the ribs encreaſe in length; for the ſeventh rib was three inches long, and its cartilage an inch and a half; the four laſt of the *Coſtæ Nothæ* do again gradually leſſen in length; for the laſt rib of all was only an inch and three quarters long, and its cartilage did not reach the *Sternum*, tho' the firſt, ſecond, and third of the *Coſtæ Nothæ* did; the *Sternum* conſiſted of ſeven bones, according to the number of the fore-ribs, that are faſtened to them; at the beginning of the *Sternum*, there jutted out a ſharp bony cartilage, which, from its figure, Dr. *Tyſon* calls *Cartilago Enſiformis*; and here one extremity of the clavicle was faſtened; at the end of the *Sternum*, towards the belly, there was a broad, roundiſh cartilage, which therefore he calls *Cartilago Scutiformis*:

mis: There were two *Claviculæ*, or collar-bones, each an inch and a half long, with an extremity faſtened to the firſt bone of the *Sternum*, or the *Cartilago Enſiformis*, and the other to the ſpine or *Scapula*, near its conjunction to the *Os Humeri*; by means of this bone, it can more advantageouſly bring its fore-feet to its mouth, as it uſes to do when it feeds itſelf, like the monkey-kind, being provided as men are with *Claviculæ:* The *Scapula* or ſhoulder-blade, was about two inches long, and about an inch and a half broad; its ſpine, tho' thin, yet the nearer it approached the ſhoulder, it grew larger and flatter; into the *Sinus* of the neck of the *Scapula*, the head of the ſhoulder-bone was received, or fore-thigh bone; and to that protuberance called the *Acromium*, the end of the clavicle was faſtened; this thigh-bone of the fore-legs was about two inches three quarters long, it was thick and ſtrong, having a large rough ſpine jutting forwards, and running half its length; the lower extremity of this thigh-bone, to which were faſtened the *Tibia* and *Fibula*, grew very broad, being almoſt an inch in breadth; above, where this bone began to grow broad, there was on the outſide a large protuberance, and on the inſide a large oblong *Foramen*, or hollow paſſage, formed by a ſmall bone, ariſing from the internal fore-part of the thigh-bone, where it began to grow larger, and was afterwards united to that part of the baſis of this bone, where the *Fibula*, or *Focile minus* is joined; juſt in the middle of the baſis of this bone there was a large *Sinus*, which backwards appeared deeper, looking into another deep *Sinus* of the *Tibia*, by which means theſe bones were ſo firmly articulated together, as not to be eaſily put out of joint; the *Tibia*, or *Focile Majus* was a ſtrong bone about two inches in length, which was extended upwards above a quarter of an inch above its articulation with the thigh-bone, and at the other end was faſtened to the outward bone of the *Tarſus*; the *Fibula* or *Focile Minus*, was a ſmaller bone, placed more internally, and more forwards, and not ſo long as the *Tibia*, being articulated above, but not ſo firmly, with the thigh-bone, and below with the internal bone of the *Tarſus*; for there were but two bones of the *Tarſus*, with each a ſmall *Sinus*, for receiving the heads of the *Fociles:* The bones of the *Metatarſus* were four, or perhaps five, to which four fingers or toes of the fore-feet were joined; the innermoſt toe had but two articulations, or joints, but at the end was provided with a large hooked ſtrong nail; the other four fingers had each three joints, armed with hooked nails, as the firſt: The hinder legs were faſtened to the trunk of the body by the *Os innominatum*, which

in a ſtreight line was three inches long; in the head of the hinder thigh-bone, and deeper in, there was a ſpace for the faſtening the ligament, from which ſpace there was a *Sinus* which led outwards; ſo that the brims of the *Acetabulum* were not an entire circle, but broken off here; here alſo are the *Oſſa Marſupialia*, or *Janitores Marſupii*; the hinder thigh-bone was little more than three inches long, it was a roundiſh ſtrong bone; but the *Tibia*, or *Fovile Majus* of the hinder leg, was ſomewhat longer, and a little curved; the *Fibula*, or *Focile minus* was about the ſame length, but ſtreighter and more ſlender; this towards the foot was articulated to the *Os Calcis*, as the *Tibia* was to the *Talus*, or *Aſtragalus*; and theſe two bones, according to Dr. *Tyſon*, are the *Tarſus*; joining to them were the bows of the *Metatarſus*, and to theſe the *Phalanges* of the fingers and toes; in the innermoſt, or the thumb, there were only two joints, in the other four toes or *Digiti*, in each were two joints; the end of the thumb was more flatted than the ends of the other toes; the thumb, as was obſerved, had a flat nail like that of a man; in the others the nails were long and curved: At the articulation of each joint of the toes, on the under ſide, were two ſmall bones, called *Oſſa Seſſamoidea*, and theſe both in the fore and hinder feet.

Fig. 1. Plate VIII. repreſents the *Poſſum* drawn from the life; Fig. 2. the ſlit or aperture in the belly, that goes to the *Marſupium* or pouch: Fig. 3. A the *Marſupium* turned inſide outwards, where may be obſerved the hair or furr that covers it, which may help to keep its young warm; B B the two hinder legs cut off; C the *Foramen* of the *Anus*; which is alſo the common external vent, both of the *Rectum*, bladder of urine, and the *Uteri* alſo: D the beginning of the tail: Fig. 4. is the ſkeleton; A A the *Roſtrum*, or ſnout; *b b* the *Cranium*, or ſkull; *ccc* a bony ridge, or the *Protuberantia Oſſea longitudinalis*, which ran the length of the *Cranium*, and over a part of the *Roſtrum*; *d* the lateral ridge, *Protuberantia Oſſea lateralis*, which, like a penthouſe, jutted over the hinder part of the *Cranium*; *e f* the *Os Zygomaticum*; *e* its proceſs from the *Os Temporum*, and *f* that from the *Maxilla ſuperior*; *g* a *Foramen* or hole in the internal *Canthus* of the orbit of the eye, that leads into the noſtrils, and by a duct conveys the tears, or moiſture of the eyes into them; *h* a *Foramen* or hole in the upper jaw, for a paſſage to the veſſels; *i* a protuberance of the *Os Frontis*; K a ſuture of the *Os Narium*; *l l* the lower mandible, or jaw-bone; *m* the ſuperior proceſs of the under jaw; *n* the inferior proceſs of the under

Fig. I.

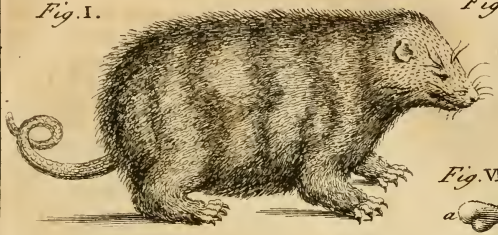


Fig. II.

Fig. III.

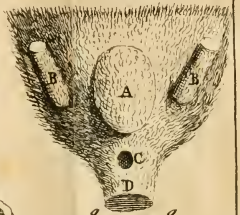


Fig. VI.

Fig. V.

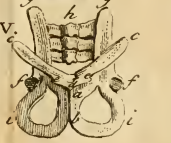
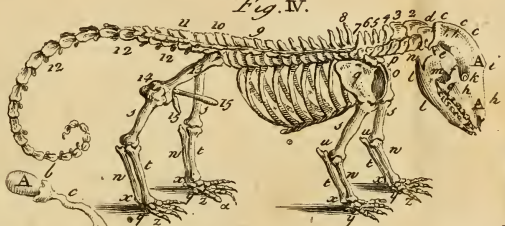


Fig. IV.



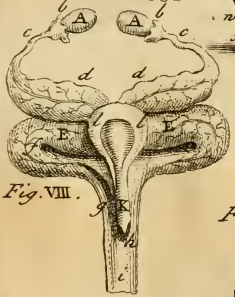


Fig. IX.

Fig. X.

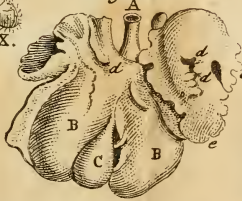


Fig. VII.

Fig. VIII.

Fig. XI.

Fig. XIII.

Fig. XII.

Fig. XV.

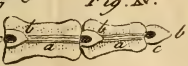


Fig. XIV.

der jaw; *o* the *Clavicula* on one ſide; *p* the *Cartilago Enſiformis* of the firſt bone of the *Sternum*; *q* the *Scapula* or ſhoulder-blade bone; *r* the ſpine of the *Scapula*; SSSS the thigh-bones; TTTT the *Tibia* or *Focile Majus* of all the legs; *uu* part of the *Tibia* in the fore-legs extended beyond articulation; WWWW the *Fibula* or *Focile Minus*; *xxxx* the bones of the *Tarſus*; *yyyy* the bones of the *Metatarſus*; *zzzz* the toes; *aa* the thumbs of the hinder feet; 1 the firſt *Vertebra* of the neck, called *Atlas*; 2, 3, 4, 5, 6, 7 the 2d, 3d, 4th, 5th, 6th, 7th *Vertebræ* of the neck; 8 the firſt *Vertebra* of the *Thorax*; 9 the firſt *Vertebra* of the loins; 10 the firſt *Vertebra* of the *Os Sacrum*; 11 the firſt *Vertebra* of the *Os Coccygis*, or tail; 12, 12, 12, 12, the ſpines or hooks on the inſide of the tail; 13, 14 the *Os innominatum*, where 13 is the *Os ilium*, 14 the *Os iſchium*, or *Coxendicis*; 15, 15, are the *Oſſa Marſupialia*, or *Janitores Marſupii*; **** the ribs, thirteen in all; Θ the *Cartilago Scutiformis*: Fig. 5. the ſituation of the *Oſſa Marſupialia*, &c. *aa* the *Oſſa Pubis*; *b* the coalition, or joining of the *Oſſa Pubis*; *cc* the two *Oſſa Marſupialia*, or *Janitores Marſupii*; *de* the baſis of the *Oſſa Marſupialia*, where joined to the *Os Pubis*, *d* the internal head of the baſis, *e* the external; *ff* the *Acetabulum*, or ſocket, for receiving the head of the thigh-bone; *gg* the *Os ilium*; *hh* the *Vertebræ* of the *Os Sacrum*; *ii* the *Os iſchium*, or *Coxendicis*: Fig. 6. the foreſide of the thigh-bone, of the fore leg; *a* the head of the thigh-bone, where it is faſtened to the *Scapula*; *b* a large rough ſpine, which runs above half the length of this thigh-bone; *c* a protuberance of this bone on the outſide; *d* a large *Foramen*, or hollow paſſage; *e* a *Sinus* for receiving the head of the *Tibia*; *f g* the baſis, or lower extremity of the thigh-bone: Fi. 4. Pl. VII. the ſtomach and guts; A the *Gula*; BB the ſtomach; *c* a perforation of the ſtomach cauſed by an ulcer there; *dd* the two pouchings out of the ſtomach at the two ends; *e* the *Pylorus*; *f* the beginning of the *Duodenum*; *ghi* KLMN *opq* the ſmall guts, and their convolutions, ſome of which lie hid and out of ſight; but the order, in which they follow each other, is ſignified by the order of the letters of the alphabet; ſo that *g* follows *f*, and *g* is ſucceeded by *i* and *i* by K, and ſo on to *q* where the *ilium* diſcharges itſelf into the *Cœcum*, or, if that is full, into the *Colon*, at the firſt letter S; RR the *Cœcum*; SSS the *Colon*; T the *Rectum*; U the firſt meſentery, or *Meſenterium minorum inteſtinorum*; *w* the ſecond meſentery, or *Meſenterium majorum inteſtinorum*: Fi. 7. Pl. VIII. the

urinary and uterine parts; AA the two kidneys; *bb* the emulgent veins; *cc* the emulgent arteries; *dd* the *Glandulæ Renales*; *ee* the two *Ureters*; *f* the inſertion of the left *Ureter* into the neck of the bladder; G the bladder of urine turned aſide; *h* the *Urethra*; *ii* the two *Vaginæ Uteri*; K the common paſſage from the *Urethra*, and the two *Vaginæ*; *l* the *Aorta*; *m* the *Cava*; *nnn* the ſpermatic arteries; *oooo* the ſpermatic veins; *ppp* the hypogaſtric arteries and veins; *rrr* the *Alæ Uteri*, or rather the *Alæ Cornuum*; SS the *Ovaria*; *tt* the *Tubæ Fallopianæ*; *uu* the *Cornu Uteri* of the left ſide opened; *w* the *Cornu Uteri* of the right ſide un-opened; *xx* the two *Uteri* opened; *y* the diaphragm that divides the two *Uteri*; *zz* the imperfect diaphragm, which partly divides each *Uterus*, and lies over the paſſage of that part of the *Uterus*, which is doubled and tends to the *Vaginæ*: Fig. 8. the uterine parts more particularly, AA the two *Ovaria*; *bb* the *Fimbria Foliacea*; *cc* the *Tubæ Fallopianæ*; *dd* the two *Cornua Uteri*; EE the two *Ureters* reduplicated; *f* a ſlit in the neck of the left *Uterus* to ſhew its paſſage into the *Vagina* on that ſide; *g* the left *Vagina* opened; *h* the *Oſtium*, or mouth, of the right *Vagina*; *i* the common paſſage from the *Urethra* and *Vagina*; K the *Urethra*; *ll* the bladder of urine cut off: Fig. 9. the hairy *Tophus*. Fig. 10. the liver, A the *Vena Cava*; BBB the three lobes of the liver; C the bladder of gall; *ddd* the fiſſures of the body of the liver; *eee* the inciſures at the edges of the liver: Fig. 11. A the ſpine of the ſecond *Vertebra* of the neck; *b* repreſents its thickneſs; *c* a large *Sinus* for receiving the firſt *Vertebra*; *d* the *Dens*, or tooth of this *Vertebra*; *e* the *Proceſſus obliquus ſuperior* of one ſide; *f* the *Proceſſus obliquus inferior* of the ſame ſide: Fig. 12. A the ſpine of the 3d *Vertebra* of the neck, where is ſhewn its natural thickneſs; *b* the hole thro' which the *Medulla ſpinalis* paſſes; *cc* two ſmall *Foramina* for the paſſage of the veſſels; *d* repreſents the cleft at the top of the ſpine; *ee* the two *Proceſſus obliqui ſuperiores* before; *ff* the two *Proceſſus obliqui inferiores* before: Fig. 13. the firſt *Vertebra* of the *Thorax*; A the ſpine, which is long and acute; *bb* the oblique proceſſes before; *cc* the oblique proceſſes behind; *dd* the tranſverſe proceſſes; *ee* the place where the ribs are faſtened; *f* the hollow where the *Medulla ſpinalis* paſſes: Fig. 14. the fourth *Vertebra* of the loins; *aa* the two upper oblique proceſſes behind; *b* the ſpine; *cc* the two under oblique proceſſes behind: Fig. 15. the ſecond and third *Vertebræ* of the tail; *aa* two *Vertebræ* of the tail; *bbb* the ſpines,

or

or hooks on the inside, by means of which it can better hang by its tail; *cc* a hollow, or *Foramen* in the middle of these spines, thro' which blood-vessels pass.

Observations in New England; *by Mr.* Benj. Bullivant. Phil. Trans. N° 240. p. 165.

THE plague of the back is very different from an *Empyema*; it seems to be more of a cholic, yet it is doubtless a nervous disorder; the country people have learned of the *Indians* to steep *Castoreum* in rum, and so cure it: The fireflies seem to be a kind of flying glow-worm; the lustre is placed as in that animal; if you kill the fly, you will find what sparkles to be a small gelly-like substance, which separated into atoms, emits still in the dark a lustre proportionable to the magnitude of each atom: The eggs of butterflies are testaceous, and nearly as big as a wren's, beautifully studded with gold and silver: Tortoises are amphibious; their eggs are found in great quantities by the sides of ponds; they are without shells, like those in a hen's belly: Grashoppers, in dry years, are very mischievous to the husbandmen; they are very numerous, of a grey colour, and about 3 inches long; in *July* they become flying animals, and have a kind of regimental discipline, and officers, which shew larger, and more splendid wings than the commoners, and are the first to take wing: Mr. *Bullivant* had shot the humming-bird with sand; he had one for some weeks in his custody; he put a straw for a perch into a *Venice* glass tumbler, tied over the mouth with a paper, in which he cut holes for the bird's bill, which was about as long and as small as a taylor's needle, and laying the glass on one side, he set a drachm of honey by it, which it soon scented, and with its long tongue fed daily; it muted the honey pure: There is a species of frogs pretty large, and its cry perfectly resembles that of a bull: The *Clam* is observed to have a plain pipe or *Proboscis*, from which he ejects water, if compressed.

To enlarge the Divisions *of the* Barometer; *by Mr.* Steph. Gray. Phil. Trans. N° 240. p. 176.

A, Fig. 5. Plate VII. is a long square table; towards one end a square column B B is erected, on which a square socket C slides, from one side of which proceeds a crooked arm D E; at D is a screw-hole to receive the screw, and at E a ring to support the tube of the microscope F; from the other side

ſide of the ſocket comes a ſhort arm G, with a ſcrew-hole to receive the long ſcrew II, whoſe length may be about ſix or ſeven inches; its lower end, by a ſmall hole in its centre, reſts on the end of a ſmall ſcrew, that comes thro' the ſcrew-hole in the arm H, which is fixed on the back-ſide of the column; the upper end of the ſcrew is filed leſs than the body of the ſcrew, and goes thro' the centre of the round plate without ſhaking; and to prevent its doing ſo, either upwards or downwards, there is added a ſpringing plate *n*, which keeps the ſhoulder of the ſcrew cloſe to the under ſide of the plate K; over this plate there goes an index *o*, and over that an handle L, upon the end of the ſcrew, which comes thro' the centre of the plate, which is rivetted to the top of the column B B; the teeth of the ſcrew muſt be of that ſize, as to have juſt 10 in an inch; the fore-ſide of the column muſt be divided into inches and tenths, beginning about the height of the ſocket H, where the lower end of the ſcrew reſts, and ſo continuing to the top of the column; the limb of the round plate muſt be divided into 100 parts; in the *Focus* of the eye-glaſs of the microſcope is fixed an hair, or very fine ſilver wire, in an horizontal poſition: When you uſe this inſtrument, take hold of the handle, and looking thro' the microſcope, turn the ſcrew till you have brought the hair to touch, as it were, the ſurface of the mercury *m*; then obſerve what diviſions are cut on the column, by the upper or under edge of the ſocket which are tenths of an inch; obſerve likewiſe to what parts the index points on the limb of the round plate, which are hundreds of a tenth, or thouſand parts of an inch; when you perceive the mercury varied, raiſe or depreſs the microſcope, till the hair be brought to its ſurface, as before; then by ſubſtracting the leſſer from the greater of the two obſerved numbers, you will have the variation in inches and thouſand parts: This inſtrument becomes a micrometer on the ſame principles; the thermometer is alſo capable of the like improvement.

The chief Uſe of Reſpiration; *by Dr.* Will. Muſgrave. Phil. Tranſ. N° 240. p. 178.

DR. *Thurſton* aſſerts, that the chief uſe of reſpiration conſiſts in maintaining a due motion of the blood; but his arguments ſeeming to be inſufficient, Dr. *Muſgrave* pitched on the following experiment: He took a large, middle aged healthy dog, and having freed the *Trachea* from the adjacent parts, he cut it off juſt beneath the *Pomum Adami*, and turned the looſe

looſe end outwards, and ſtopped up the *Trachea* with a cork; a few, but very violent ſtruggles ſucceeded, in which the *Sternum* was raiſed, as in the deepeſt inſpiration, and thus the dog died: From the ſtopping of his breath to the laſt motion diſcernible in any part of the body, was by a watch, two minutes; after this the *Thorax* was immediately thrown open, where the blood was ſeen ſtagnating in the lungs; the *Arteria Pulmonalis*, the right ventricle of the heart, with its appending auricle, and the two great trunks of the *Cava* were greatly diſtended with blood; the *Vena Pulmonalis*, left auricle, and ventricle of the heart were in a manner empty: This experiment proves, that reſpiration promotes the paſſage of the blood thro' the lungs, and that this ſeems to be its principal uſe.

Black-Lead; *by Dr.* Plot. Phil. Tranſ. N° 240. p. 183.

THE mineral ſubſtance called *Black-Lead*, found only at *Keſwych* in *Cumberland*, and there called *Wadt* or *Kellow*, by Dr. *Merret*, *Nigrica fabrilis*, from its uſe in ſcoring, as the *Rubrica fabrilis*, or red oker, is ſo far from having any thing of metal therein, that it is incapable of fuſion, much leſs of ductility; nor can it be reckoned amongſt the ſtones, for want of hardneſs; it remains therefore that it be claſſed amongſt the earths, tho' it diſſolve not in water, as moſt earths will, except ſtiff clays and okers; amongſt the latter of which Dr. *Plot* conjectures it may be reckoned, it ſeeming to be a ſpecies of cloſe earth, of very fine and looſe parts, ſo burnt, that it is become black and ſhining, diſcolouring the hands, as all okers do; whence the moſt proper name that can be given it, perhaps, is *Ochrea nigra*, or *Black Oker*, being a ſtony ſort, as there are ſtony ſorts of the red and yellow okers, as well as clay.

The Rubricks *for the Seat of* Eaſter, *according to the* Julian *Account, explained; by Dr.* Wallis. Phil. Tranſ. N° 240. p. 185.

THE fundamental rule of the *Nicene* council, which we pretend to follow for the keeping of *Eaſter*, is to this purpoſe; *Eaſter* day is to be that *Sunday*, which falls upon, or next after, the firſt full moon, which happens next after the vernal *Equinox*; this vernal *Equinox* was then obſerved to fall on the 21ſt of *March*, tho' it now falls on the 11th of *March*, or ſometimes on the 10th of *March*; and therefore, inſtead

inſtead of next after the vernal *Equinox*, we ſay, next after the 21ſt of *March:* But then it is ſaid (by miſtake, as Dr. *Wallis* ſuppoſes) after the firſt full moon, inſtead of upon, or next after the firſt full-moon (for ſo it is to be underſtood) and then it is added, and if the full-moon happen on a *Sunday*, *Eaſter* day is the *Sunday* after; which muſt needs be a miſtake; for in ſuch caſe, it is to be that *Sunday*, and not the *Sunday* after; and ſo the tables agree contrary to this note, both that for 40 years, and that to find *Eaſter* for ever; and ſo it was obſerved in the years 1668, 1678, and 1682; and whenever it happens that the eccleſiaſtical full-moon falls on a *Sunday:* The only doubt remains, on what day we muſt reckon the eccleſiaſtical full-moon to fall on; for we are not to judge either the *Equinox*, or the full-moon, according as they happen in the heavens, or in our almanacs, but according to the Paſchal tables, fitted to the time of the *Nicene* council; and accordingly we are to account the *Equinox* to be now, as then it was, on *March* 21: The golden number, adapted to the cycle of 19 years, after the end of which it begins again at 1, 2, 3, *&c.* is placed in the firſt column of our calendar, to inform us on what day, of ſuch a year, the new moon is ſuppoſed to happen in each month; and the 15th day of that moon is reputed the full; thus the golden number for the year 1698 is 8, that is, this is the 8th year of ſuch decennoval cycle, or circle of 19 years, commonly called *Cyclus lunaris*, or the cycle of the moon; as the other circle of 28 years is called *Cyclus Solaris*, the circle of the ſun, or rather of the Sunday letter; and this number 8 ſtands in the calendar at *Mar.* 6th, which we muſt therefore ſuppoſe to be new moon, tho' the new moon were indeed *Mar.* 2d; now *Mar.* 6th being the new moon, or firſt day of the reputed lunar month for ſuch year, *March* 20th will be the 15th day, or the reputed full moon for the month of *March* this year, which happens to be Sunday, the Dominical letter for this year being B; but this happening before *March* 21ſt, the ſuppoſed *Equinox*, cannot be the Paſchal full moon, but we muſt wait for another; and we ſhall then find the golden number 8 ſtanding at *April* 5th, for the new moon of *April* the ſame year; and therefore the full moon, or 15th day of that reputed lunar month is *April* 19th; which being *Tueſday*, the Sunday next following is *April* 24th, where ſtands B, the Sunday letter for this year, which is therefore to be *Eaſter* day, according to the intent of theſe tables, and it was obſerved accordingly: But it were to be wiſhed, there had been ſome-

where

where a rubrick to direct how to find this reputed full moon, and what is the use of the golden number. The difference of the ecclesiastical account in the Paschal tables, from that of the heavens, both as to the *Equinox* and full moons arises hence. 1. The common *Julian* year, by which we reckon, of 365 days and 6 hours, is somewhat too long; being about 11 minutes of an hour longer than the true solar year; by reason whereof, the *Equinox*, and other annual seasons, go forwards about 11 minutes every year; which from the time of the *Nicene* council till now, amounts to about 11 days; so that the *Equinox*, which then happened *March* 21st, is now come back to our *March* 10th; which upon Pope *Gregory*'s reforming the *Roman* calendar, above 100 years since, causes the difference of 10 days between what we call the new style and the old. 2. It was then supposed, that in 19 years, which is the compass of the golden number, the lunations of new-moon and full-moon did return to the same day and hour, as they were 19 years before; but tho' this be pretty near the truth, yet it comes short by about an hour and a half, which hour and a half in every 19 years, doth, since that time, amount to four or five days; whence it happens, that the reputed full-moon is later by four or five days, than that of the heavens; but our *Easter* is reckoned according to the reputed full-moons, derived from the golden number, and not according to those of the heavens.

An extraordinary Rainbow *at* Chester; *by Mr.* Edm. Halley Phil. Transf. N° 240. p. 193.

AUGUST 6th, 1698, between 6 and 7 o'clock in the evening, Mr. *Halley* observed an *Iris*, exceedingly vivid as to its colours, at first on the south side only, but in a little time with one entire arch; and soon after, the beams of the sun being very strong, there appeared a secondary *Iris*, whose colours were more than ordinary bright, but inverted as usually; that is, the red was inwards, which in the primary *Iris* is outwards, and *é contra* for the blues; but what appear'd most observable was, that with these two concentric arches, there appeared a third arch, nearly as bright as the secondary *Iris*, but coloured in the order of the primary, which took its rise from the intersection of the horizon and primary *Iris*, and went a-cross the space between the two, and intersected the secondary, as in Fig. 1. Plate IX. AFCG intersects the secondary *Iris* EFGD, dividing the arch ED nearly into three equal parts; but at first the arch AF did not appear,

which afterwards became as bright as the former; he obſerved the points F and G to ariſe, and the arch FG gradually to contract, till at length the two arches FHG, and FG became coincident; when, for a great ſpace, the ſecondary *Iris* loſt its colours, and appeared like a white arch at the top; he alſo obſerved, that at the points F and G, the interſection of the interior red of the ſecondary *Iris*, and the exterior red of the arch was much more intenſely red than the outward limb of the primary *Iris*; and that during the whole appearance, the upper part of the third *Iris* was not at all viſible beyond the interſections FG: This uncommon ſight continued for about 20 minutes. Mr. *Halley* was at firſt amazed therewith, but afterwards recollecting that the ſun ſhone along the river *Dee*, which from thence empties itſelf W. N. W. where the ſun then was, he concluded that this ſecondary arch AFHGC was produced by the beams of the ſun reflected from the water, which at that time was very calm; and it had been much more bright, had it been then high, as it was low-water, when all the ſands were bare.

A Roman Shield; *by Mr.* Thoresby. Phil. Tranſ. N° 241 p. 205.

THE ancient *Romans* had three words, *viz. Scutum*, *Parma*, and *Clypeus*, to expreſs that defenſive weapon we generally call in *Engliſh* a ſhield, which, notwithſtanding their different forms or matter, their authors, eſpecially in the declenſion of the empire, frequently confound, as probably we now do ſhield, buckler, and target: Of theſe ſhields or bucklers, Mr. *Thoresby* had one, ſee Fig. 2. Plate IX. of the *Parma* kind, rightly ſo called, *quod è medio in omnes partes ſit par*; whereas the *Scutum* was moſtly oval, tho' ſometimes imbricated, with corners equally broad; it is 15 inches diameter, whereof a little more than a third part was poſſeſſed by the *Umbo*, or protuberant boſs, which is made of an even convex plate, wrought hollow on the inſide to receive the gladiator's hand; on the centre of this is a ſmaller boſs, wherein there ſeems to have been fixed ſome kind of *Cuſpis*, or ſharp offenſive weapon; from the ſaid *Umbo*, the ſhield is four inches and a half broad on each ſide, in which are eleven circular equidiſtant rows of braſs ſtuds of that ſize, that 222 are ſet in the outmoſt circle, which is four foot, wanting three inches, the circumference of the buckler; the inmoſt circle is placed upon the *Umbo* itſelf, the next 8 upon as many circular plates

plates of iron, each a third of an inch broad; the two outermoſt on one thicker plate, an inch broad; in the little intervals, between theſe circular plates, are plainly diſcovered certain croſs *Laminæ*, that paſs on the back of the other, from the *Umbo* to the exterior circle; and theſe iron plates are alſo about the third part of an inch at the broader end towards the circumference, but gradually contracted into a narrower breadth, that they may be brought into the compaſs of the *Umbo* at the centre; the inner coat, next to thoſe iron plates, is made of very thick, hard, ſtrong leather, which cuts bright, ſomewhat like parchment; upon this is a ſecond cover of the ſame, and on the outſide of this are plaited the iron pins, that run thro' the braſs ſtuds; for the abovementioned braſs ſtuds are caſt purely for ornament upon the heads of the ſaid iron pins, the ſixth part of an inch long, that none of the iron appears. The next cover to the plaiting of the ſaid nails (which paſs thro' the circular and croſs iron plates, and both the leather covers) is a pure linen cloth, but diſcoloured, tho' perhaps not with age only, but ſour wine and ſalt, or ſome other liquid wherein it ſeems to have been ſteeped. And laſtly, upon the ſaid linen is the outmoſt cover, which is of ſofter leather: All which coats, that compoſe the ſhield, are bound together by two circular plates of iron, a thin and narrow one towards the centre and a thicker and larger one, an inch broad at the circumference, which is curiouſly nailed with two rows of very ſmall tackets, above 400 in number; the vacant holes, whence ſome of the nails are dropped out, are little bigger than to admit the point of a pair of ſmall compaſſes; both which rims do likewiſe faſten the handle (the only part of wood) which has alſo ſix other iron plates, about three or four inches long to ſecure it.

Mr. *Thoreſby* procured another ſhield, which differed from this not ſo much in ſize (tho' it was completely a foot larger in the circumference) as in the form: For, whereas, this already deſcribed is almoſt flat, except the ſwelling *Umbo*, this is abſolutely concave, and from the ſkirts of the protuberant boſs in the middle, it riſes gradually to the circumference, which is nigh three inches perpendicular from the centre. This has 14 rows of the like braſs ſtuds, but the circular plates of iron they are fixed in, do not lie upon other croſs plates, as the former doth, but each from the centre upon the outer edge of the other, which occaſions its riſing in that concave manner.

That these were part of the accoutrement of the *Roman Equites*, rather than of either the *Velites* or *Hastati*, Mr. *Thoresby* concludes, because that tho' all in general had shields, yet those of the *Velites*, who were as the forlorn hope, seem more slight, and are expressly said to be *è ligno corio superinducto*; those of the *Hastati* are not only said, *è pluribus lignis & asserculis constit.* &c. but were also four foot long to cover the whole body, when stooping; of which kind were likewise those of the *Principes* and *Triarii*. Whereas the description that the anonymous author of *Roma illustrata* with *Fabricius*'s notes, gives in his *Armatura Equitum*, comes the nighest this, *Scutum sive Parmam habebant ex bovillo Corio, arte leviter durata*; but then he adds, *eóque mero nulla materia subjecta*, omitting not only the ornamental studs, but the iron work which *Camillus* first contrived as a defence against the immense swords of the *Gauls*.

The Imperfection of an Organ; *by Dr.* J. Wallis. Phil. Transf. N° 242. p. 249.

DR. *Wallis* thinks it is evident, that the pipe in the organ is intended to express a distinct sound at such a pitch, that is, in such a determinate degree of gravity or acuteness; or (as it is now called) flatness or sharpness; and the relative or comparative consideration of two (or more) such sounds or degrees of flatness or sharpness, is the ground of (what we call) concord and discord; that is, a soft or harsh coincidence.

Now, concerning this, there were amongst the ancient *Greeks*, two (the most considerable) sects of musicians; the *Aristoxenians* and *Pythagoreans*.

They both agreed thus far, that *Dia-tessaron* and *Diapente*, do together make up *Dia-pason*; that is, (as we now speak) a fourth and fifth do together make up an eighth or octave; and the difference of these two, *viz.* of a fourth and fifth, they agreed to call a tone, which is now called a whole note.

Such is that in our present musick of *la, mi*, (or as it was won't to be called *re, mi*) for *la, fa, sol, la*, or *mi, fa, sol, la*, is a perfect fourth: And *la, fa, sol, la, mi*, or *la, mi, fa, sol, la*, is a perfect fifth; the difference of which is *la, mi*, which is what the *Greeks* call the *Dia-zeutic* tone; which disjoins two fourths on each side of it, and being added to either of them, doth make a fifth; which was in their musick, from *Mese* to *Parамese*; that is in our musick, from A to B; supposing

poſing *mi* to ſtand in *B-fa-b-mi*, which is accounted its natural poſition.

Now, in order to this, *Ariſtoxenus* and his followers took that of a fourth, as a known interval, by the judgment of the ear; and that of a fifth likewiſe: And conſequently that of an octave, as the aggregate of both; and that of a tone as the difference of thoſe two.

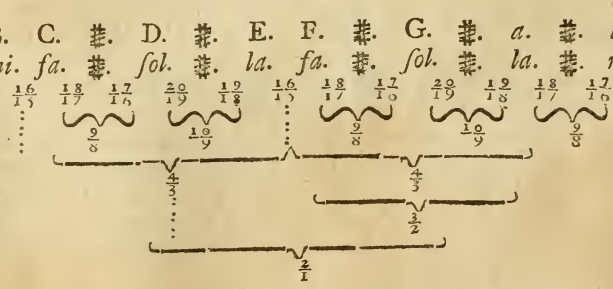
And this of a tone, as a known interval, they took as a common meaſure, by which they eſtimated other intervals: Accordingly they accounted a fourth to contain two tones and a half; a fifth to contain three tones and a half, and conſequently an eighth to contain ſix tones, or five tones and two half tones: And at this rate our practical muſicians talk of notes and half-notes at this day; ſuppoſing an octave to conſiſt of twelve hemi-tones or half-tones; but *Pythagoras*, and thoſe who follow him, not taking the ear alone to be a competent judge in a caſe ſo nice, choſe to diſtinguiſh theſe, not by equal intervals, but by due ratio's: And thus it was followed by *Zarline*, *Kepler*, *Cartes*, and others, who treat of ſpeculative muſick in this and the laſt age; accordingly they accounted that of an octave to be, when the degree of gravity, or acuteneſs of the one ſound to that of the other is double, or as 2 to 1: That of a fifth, *Seſqui-alter*, or as 3 to 2: That of a fourth, *Seſqui-tertian*, or as 4 to 3; accounting that to be the ſweeteſt ratio, which is expreſſed in the ſmalleſt numbers, and therefore next to the *Uniſon*, that of an *Octave*, 2 to 1; then that of a fifth, 3 to 2; and then that of a fourth, 4 to 3; and thus that of a fourth and fifth do together make an eighth, for $\frac{4}{3} \times \frac{3}{2} = \frac{4}{2} = \frac{2}{1} = 2$, or the ratio of 4 to 3, compounded with that of 3 to 2, is the ſame with that of 4 to 2, or 2 to 1. And conſequently, the difference of thoſe two, which is that of a tone, or full note, is that of 9 to 8. For $\frac{4}{3}) \frac{3}{2} (\frac{9}{8}$; or if out of the ratio of 3 to 2 you take that of 4 to 3, the reſult is that of 9 to 8.

Now according to this computation, it is manifeſt that an *Octave* is ſomewhat leſs than ſix full notes; for, as was firſt demonſtrated by *Euclid*, the ratio of 9 to 8, being ſix times compounded, is ſomewhat more than that of 2 to 1. For $\frac{9}{8} \times \frac{9}{8} \times \frac{9}{8} \times \frac{9}{8} \times \frac{9}{8} \times \frac{9}{8} = \frac{531441}{262144}$, is more than $\frac{524288}{262144} = \frac{2}{1}$. This being the caſe; they allowed indiſputably to that of the *Dia-zeutic* tone, *la*, *mi*, the full ratio of 9 to 8, as a thing not to be altered, being the difference of the *Dia-pente* and *Dia-teſſaron*, or the fifth and fourth: All the difficulty was, how the remaining fourth

mi,

mi, *fa*, *ſol*, *la*, ſhould be divided into three parts, ſo as to anſwer pretty near the *Ariſtoxenians* two tones and a half; and might altogether make up the ratio of 4 to 3, which is that of a fourth or *Dia-teſſaron*: Many attempts were made to this purpoſe; and according to thoſe, they gave names to the different *Genera* or kinds of muſick, the *Diatonic*, *Chromatic* and *Enarmonic* kinds, with the ſeveral ſpecies, or leſſer diſtinctions under thoſe generals: The firſt was that of *Euclid*, which moſt generally obtained for many ages, and allows to *fa*, *ſol*, and to *ſol*, *la*, the full ratio of 9 to 8; and therefore to *fa*, *ſol*, *la*, which we call the greater third, that of 81 to 64; for $\frac{9}{8} \times \frac{9}{8} = \frac{81}{64}$, and conſequently to that of *mi*, *fa*, which is the remainder to a fourth, that of 256 to 243; for $\frac{81}{64}) \frac{4}{3} (\frac{256}{243}$, that is, if out of the ratio of 4 to 3 we take that of 81 to 64, the reſult is that of 256 to 243; to this they gave the name of *Limma*, that is the remainder, to wit over and above two tones; but in common diſcourſe, when we do not pretend to ſpeak nicely, nor intend to be ſo underſtood, it is uſual to call it an *Hemi-tone*, or half-note, as being very near it, and the other, two whole notes; and this is what *Ptolemy* calls *Diatonum Ditonum*, of the *Diatonic* kind with two full tones: Againſt this it is objected, as not being the moſt convenient diviſion, that the numbers of 81 to 64 are too great for that of a *Ditone*, or greater third, which is not harſh to the ear, but is rather ſweeter than that of a ſingle tone, whoſe ratio is 9 to 8; and in that of 256 to 243, the numbers are yet much greater; whereas there are many ratio's, as $\frac{5}{4}$, $\frac{6}{5}$, $\frac{7}{6}$, $\frac{8}{7}$, in ſmaller numbers than that of 9 to 8, of which in this diviſion, there is no notice taken: To rectify this, there is another diviſion thought more convenient, which is *Ptolemy*'s *Diatonum intenſum*, of the *Diatonic* kind, more intenſe or acute than that other, which, inſtead of two full tones for *fa*, *ſol*, *la*, aſſigns what we now call a greater and a leſſer tone; which by the more nice muſicians of this and the laſt age ſeems to be more embraced; aſſigning to *fa*, *ſol*, the ratio of 9 to 8, which they call the greater tone, and to *ſol*, *la*, that of 10 to 9, which they call the leſſer tone; and therefore to *fa*, *la*, the *Ditone* or greater third, that of 5 to 4; for $\frac{10}{9} \times \frac{9}{8} = \frac{10}{8} = \frac{5}{4}$, and conſequently to *mi*, *fa*, which is the remainder of the fourth, that of 16 to 15; for $\frac{5}{4}) \frac{4}{3} (\frac{16}{15}$, that is, if out of the ratio of 4 to 3 we take that of 5 to 4, there remains that of 16 to 15: Many other ways there are of dividing the fourth or *Dia-teſſaron*, or the ratio of 4 to 3 into three parts, anſwering to what in a looſer way of expreſſion, we call an half-note, and two whole notes; but this of $\frac{16}{15} \times \frac{9}{8} \times \frac{10}{9} = \frac{4}{3}$, is that which is now

now received as the moſt proper; where $\frac{16}{15}$ is what we call the *Hemi-tone* or half-tone in *mi, fa*; $\frac{9}{8}$ that of the greater tone in *fa, ſol*, and $\frac{10}{9}$ the leſſer tone in *ſol, la*; only with this addition, that each of theſe tones is upon occaſion divided by flats and ſharps, into two *Hemi-tones* or half-notes, which anſwers to what was called by the *Greeks Mutatio quoad Modos*, i. e. the change of mood, and what is now done by removing *mi* to another key, namely $\frac{9}{8} = \frac{18}{16} = \frac{18}{17} \times \frac{17}{16}$, and $\frac{10}{9} = \frac{20}{18} = \frac{20}{19} \times \frac{19}{18}$: Thus by the help of flats and ſharps, dividing each whole note, be it the greater or leſſer, in two half-notes, or what we call ſo, the whole *Octave* is divided into twelve parts or intervals, contained between thirteen pipes, which are commonly called *Hemi-tones* or half-notes; not that each is preciſely half a note, but ſomewhat near it, and is ſo called; for inſtance a flat in D or a ſharp in C, do either of them denote a middling ſound, tho' not preciſely in the middle between C and D, yet ſharper than C and flatter than D; accordingly, ſuppoſing *mi* to ſtand in *B-fa-b-mi*, which is accounted its natural ſeat, the ſounds of each pipe are to bear theſe ratio's to each other, *viz.*



And ſo in each *Octave* ſucceſſively following; and if the pipes in each *Octave* be fitted to ſounds in theſe proportions of gravity and acuteneſs, it will be ſuppoſed, according to this hypotheſis to be perfectly proportioned: But inſtead of theſe ſucceſſive ratio's of each *Hemi-tone*, it is found neceſſary, ſo to order the 13 pipes, containing 12 intervals, called *Hemi-tones*, as that their ſounds, as to gravity and acuteneſs, may be in continual proportion, each to its next following, in one and the ſame ratio, which all together ſhall complete that of an *Octave* or *Dia-paſon*, as 2 to 1; whereby it comes to paſs that each pipe doth not expreſs its proper ſound, but very near it, yet ſome ſmall matter varying from it, which they call *Bearing*; and is ſomewhat of imperfection

fection in this noble inſtrument, the chief of all. It may be aſked, why may not the pipes be ſo ordered, as to have their ſounds in juſt proportion, as well as this *Bearing?* In anſwer, it might very well be ſo, if all muſick were compoſed to the ſame key, or, as the *Greeks* call it the ſame mode; as for inſtance, if, in all compoſitions, *mi* were always placed in *B-fa-b-mi*, then the pipes might be ordered in ſuch ratio's as had been now defined: But muſical compoſitions are made in a great variety of modes, or with great diverſity in the pitch; *mi* is not always placed in *B-fa-b-mi*, but ſometimes in *E-la-mi*, ſometimes in *A-la-mi-re*, &c. and in ſum there is none of thoſe 12 or 13 pipes, but may be made the ſeat of *mi*; and if they were exactly fitted to any one of theſe caſes, they would be quite out of order for all the reſt; as for inſtance, if *mi* be removed from *B-fa-b-mi*, by a flat in B, to *E-la-mi*, inſtead of the ratio's, but juſt now defined, they muſt be thus ordered,

B.	♯.	C.	♯.	D.	♯.	E.	F.	♯	G.	♯	a.	b
fa.	♯.	*ſol.*	♯.	*la.*	♯	*mi.*	*fa.*	♯.	*ſol.*	♯.	*la.*	*fa.*
18/17	17/16	20/19	19/18	18/17	17/16	16/15	18/17	17/16	20/19	19/18	16/15	

where it is manifeſt, that the removal of *mi* doth quite diſorder the whole ſeries of ratio's: And the ſame would again happen, if *mi* be removed from E to A, by another flat in E; and again removed from A to D; and ſo perpetually: But the *Hemi-tones* being made all equal, they do indifferently anſwer all the poſitions of *mi*, tho' not exactly to any, yet nearer to ſome than to others; whence it is, that the ſame tune ſounds better at one key than at another.

It is aſked, whether this may not be remedied by interpoſing more pipes, and thereby dividing a note, not only as now into half-notes, but into quarter-notes, or half quarter notes, *&c.* In anſwer, it may be thus remedied in part; that is, the imperfection might thus be ſomewhat leſs, and the ſounds ſomewhat nearer to the juſt ratio's; but it can never be exactly true, ſo long as their ſounds, be they never ſo many, are in continual proportion; that is, each to the next ſubſequent in the ſame ratio: For it hath been long ſince demonſtrated, that there is no ſuch thing as a juſt *Hemi-tone* practicable in muſick, and the like may be ſaid, for the diviſion of a tone into any number of equal parts, three, four or more; for, ſuppoſing the ratio of a tone or full note to be $\frac{9}{8}$ or as 9 to 8, the ratio of the half-note muſt

must be as $\sqrt{9}$ to $\sqrt{8}$, that is, as 3 to $\sqrt{8}$, or 3 to $2\sqrt{2}$, which are incommensurable quantities; and the proportion of a quarter-note as $\sqrt[4]{9}$ to $\sqrt[4]{8}$, which is yet more incommensurate; and the like for any other number of equal parts, which therefore will never fall in with the ratio's of number to number; so that this can never be perfectly adjusted for all keys, without somewhat of *Bearing*, by multiplying pipes; unless we would for every key, or every different seat of *mi*, have a different set of pipes, of which this or that is to be used according as, in the composition, *mi* is supposed to stand in this or that seat; which vast number of pipes, for every *Octave*, would vastly increase the charge, and when all is done, make the whole impracticable.

A Periodical Palsey; *by Dr.* Will. Musgrave. Phil. Trans. N° 242. p. 257.

THE patient was a young woman of about 21 years of age, of a sanguine complexion; she had been for several days less active than usual, and after that, lost her speech and the use of her legs; she had little or no sense of feeling in them, and the left leg was drawn up as in a violent cramp; her ruddy sanguine look directed bleeding, but that did not relieve her; the Dr. therefore gave her spirit of *Sal Armon. succinat.* steel with gentian, amber, castor, and other warm cephalics; a blister was laid on her neck; a bath of wormwood and other hot herbs was prepared for her legs, and *Ung. Martiatum* used to anoint them after bathing: By these means she was, in the space of three days, able to speak again, and in a little time by the help of crutches to walk; but then omitting the medicines, tho' but for one day, she lost her speech again, and returning to the use of them, especially the spirits, she recovered it as soon; when she lost the use of her speech, there was a manifest alteration in her face, the strength, tone and vigour thereof was abated, her eyes grew dull, and her lips pale. The Dr. gave her in these circumstances 30 drops of the spirit, and in the space of two hours the change was surprising, for her eyes were quickened, and both her colour and speech returned. After the physick the Dr. had prescribed her was all used, she lost her speech, and the use of her legs on a *Tuesday* about noon, and recovered them again the following *Saturday* about the same hour; and for 10 months her use of speech and strength of legs observed the same period, with only two exceptions, *viz.* that once they returned on a *Friday*, and another time not before *Sunday:* Her *Menses* were regular as to period, but unequal as to quantity, and when they were large her condition was worst; before her speech used to go

off, she constantly lost, for the space of an hour, the use of her left arm; when her speech was leaving her, she would stammer out some few words, and after this on a sudden become mute; and when she was not able to speak, she often moaned, and made a melancholy complaining noise, and her speech was wont to return, as it went off, all on a sudden and at once: She always had, as her speech ceased, and two hours after it was gone, a pain in her left side, including the arm and leg, her left foot was then drawn up, as abovementioned; her face was high-coloured when she lost her speech, and pale when it returned; no part of her body withered, but the whole was generally cold: Some time before she was first struck speechless, her hands used to tremble, but became afterwards more steady; nor was she so dull and heavy as formerly; but generally more brisk and chearfull than in her state of health: When she enjoyed the use of her speech, she walked best, but was obliged to use a stick, being never able to go steadily; she spoke at intervals as distinctly as ever, and as loud; could sing, when capable of speaking, but at no other time. The Dr. furnished her with a new supply of medicines, and by the use of them in a little time she was grown strong, and to all appearance as well as ever; for two months she walked and spoke every day, but not at all times of the week; for her speech left her, as formerly, on *Tuesdays*, but now returned the next day afternoon.

A remarkable Instance of an absolute Command of the Joints *and* Muscles. Phil. Trans. N° 242. p. 262.

IN *Pall-mall* at *London* lived one *Clarke* called the posture-master, that had such an absolute command of all his muscles and joints, that he could disjoint almost his whole body; so that he imposed upon our famous *Mullens*, who looked on him to be in so miserable a condition, that he would not undertake his cure; tho' he was a well-grown fellow, yet he would appear in all the deformities that can be imagined, hunch-back'd, pot-bellyed, sharp-breasted; he disjointed his arms, shoulders, legs and thighs, that he appeared as great an object of pity as any; and he has often imposed on the same company where he had been just before, to give him money as a cripple, he looking so much unlike himself that they could not know him. He has been seen making his hips stand out a considerable way from his loins, and so high that they seemed to invade the place of his back, in which posture he had an extraordinary large belly: He could turn his face into all shapes, so that he alone acted all the uncouth, demure, and odd faces of a quaker's-meeting; he began young to bring his body to it, and there are several instances of

person

persons that can move several of their bones out of joint, by using themselves to it from children.

Observations in the East-Indies. Phil. Trans. N° 243. p. 273.

IT does not appear that the *Maldivia* islands were ever joined to the main land, there being no *Soundings*, as they call it, between the islands and the main, and the earth, sand and shells of the one, differing much from those of the other; the small shells called *Cowries*, which pass for money in *Bengal* and other places, are found chiefly there: The north and south *Pole* are not visible under the *Line*; for in the clearest night the horizon is overcast with so thick darkness, that no star can be seen: *Gumlack* is the house of a large sort of ants, which they make on the boughs of trees, that defend them from the weather, It is certain that cloves will attract water at some distance, which is daily experienced amongst the *Dutch* in this country, who make considerable advantage thereby; for a bag of cloves being laid over water one or two foot distant from it, will in a night's time imbibe a considerable quantity thereof and grow so moist that the water may be pressed from them: There are oyster shells in *Bantam* of about 18 inches long and 5 or 6 broad, and the fish within proportionable to the shell: At *Batavia* a whole duck was taken out of the belly of a snake, and in *Achia* they killed a snake that had a whole deer in its belly, and being taken out was so fresh and good as to dress and eat part of it; they draw their wire in moulds of several sizes, gradually, as is done in *England:* The *Chinese* gild paper with gold and silver leaf, laid on with a very good sort of varnish, the same they varnish their lacquered wares with, all which, when thoroughly dry, they put in a screw-press, and with an instrument like our plane, shave it as fine as they please; and so they cut their tobacco, which is as small as a hair: Ambergrease is found in most parts more or less; great quantities of it are found in *Japan*, the *Maldivia* islands, and to the eastward of *Java*; which, they say, they find generally fastened to the roots of trees that grow in the sea near the shore, and that while it is kept under water, it is soft and pliable like wax, and sometimes like a jelly; there is a piece shown in *India*, that weighs above 2000 ounces: The people of *Java* marry and have children at 9 or 10 years of age, the women generally leave off child-bearing at or before 30; at *Tonquin* there are women common to any that will hire them, at 8 or 9 years of age. The *Japan* and *China* varnish is made of turpentine and a curious sort of oil they have, which they mix and boil to a proper consistence, that never causes any swelling in the hands or face, *&c.* of such as make or work it; the swelling

that often happens to thoſe that work the lacquered ware, and ſometimes to thoſe that only paſs by their ſhops and look on them at work, proceeds from the lac and not the varniſh, which lac is the ſap or juice of a tree that runs ſlowly from it when cut, and is catched by pots faſtened to the tree for that purpoſe; it is of the colour and conſiſtence of cream, the top that is expoſed to the air, immediately turns black, and the way they make it all black and fit for uſe, is thus; they put a quantity into a bowl and ſtir it continually with a piece of ſmooth iron for 24 or 30 hours, which will both thicken and make it black; to this they put a quantity of very fine powder of any ſort of burnt boughs, mix it very well together, and then with a bruſh lay it ſmooth on any thing they deſign to lacquer; they let it dry very well in the ſun, then it will be harder than the board it is laid upon; after it is throughly dried, they rub it with a ſmooth ſtone and water till it is as ſmooth as glaſs, then they lay on the varniſh made of turpentine and oil, boiled to a proper conſiſtence for black lac; when they intend to have red or any other coloured lac, they mix the colour in fine powder with the varniſh and take care to lay the varniſh on as ſmooth as poſſibly they can, for therein lies the art of lacquering well; when they have a mind to paint in gold or ſilver, *&c.* they draw with a fine pencil dipped in the ſaid varniſh what flowers, birds or other figures they pleaſe, and let it lie till it begins to be dry, then they lay on the gold or ſilver-leaf or pin duſt, *&c.*

It is well known that there is amongſt the *Bramines* a language called the *Sanſcreet*, writ in a different character from what is now in uſe, in this language are written the *Porane* or ſacred hiſtory; the *Shaſtram* being to them what the Bible is to Chriſtians, as alſo the four *Beads*, whereof one is loſt, containing their divinity, law, phyſic, *&c.* and ſome other books; this language is not underſtood by all *Bramines*, but only by the ſtudious and learned amongſt them: One of the moſt eminent in this place being aſked, how long it was ſince the ſaid language was loſt, anſwered that it was ſpoken in the age of the Gods, or when they lived upon earth, which by their calculation continued many thouſand years and ended ſo many years paſt, as we reckon from the flood, or thereabouts; but they have little knowledge in chronology: It is evident, that ſeveral of the languages now ſpoken in *India*, are derived from the *Sanſcreet*, and one of the *Bramines* writ a book to ſhew, that the preſent *Hindoſtan*, or language ſpoken by the *Moors* in particular, is derived from thence; the *Bramines* obſerve our *Sunday* every week as a holy day, or day of reſt; beſides this, they have their monthly holydays, for the 8th day after the change of the moon is always a day of devotion, as alſo the

the 14th; and the 11th day from the change is a ſtrict faſt, called *Jaka Daſee*, or *Yaka Daſee*; ſo likewiſe the 8th day from the full-moon and the 14th are days of devotion, and the 11th a *Yaka Deſee*; beſides theſe, they have throughout the year ſeveral feſtival days. Upon the death of any perſon, the next of kin, eſpecially a husband for a wife, a father for a child and *vice verſâ*, as alſo a brother for a brother or ſiſter deceaſed, do mourn 15 days, during which time they eat nothing but rice and water, and eat neither *Betle*, nor mark their foreheads; but uſe ſeveral waſhings and variety of other ceremonies, as carrying victuals to gardens, groves, and tanques, to diſtribute to the poor, and make ſeveral prayers that God would grant the deceaſed a good place in the other world, forgive him his ſins, be favourable to him, *&c.* and upon the 16th day they make a feaſt, according as they are able, for all their friends and relations, and thoſe of the ſame coaſt; likewiſe yearly, upon the day of his death, they give alms, *i. e.* victuals, as they are able, to more or leſs poor, with whom they make prayers for the deceaſed.

The Motion of the Stomach *and* Guts; *by Dr.* Chr. Pitt. Phil. Tranſ. N° 243. p. 278.

IN the diſſection of a dog, the doctor obſerved that the periſtaltic motion of the guts was continued throughout the ſtomach; the *Pylorus*, that uſually appears after opening the dog, as nigh as the diaphragm, being in every waving motion, brought below the very bottom of the ſtomach; the doctor could manifeſtly obſerve a conſtriction in the middle of the ſtomach, at every motion downwards, paſſing thro' it in ſuch a manner as to be able to compreſs what was contained in its cavity; and theſe motions were as regular and orderly as ever he ſaw them in the guts: He obſerved the ſame motion in two or three others, whence one may ſafely conclude that it holds true in all: The motion of the ſtomach being performed in this manner, may give us a clear account of the quickneſs of the diſtribution of the nouriſhment, the meat being no ſooner opened by the ſpittle and liquor that we take in, than it has a free motion by the *Pylorus* into the inteſtines, which is almoſt in a full ſtream, from this compreſſion in the middle of the ſtomach.

Vegetable Salts *extracted*; *by S.* Fr. Redi. Phil. Tranſ. N° 243. p. 281.

BURN any ſort of herb, flower, fruit, wood, or whatever it be, and make aſhes thereof; with the aſhes and with pure water in its natural temper, make the lee, which afterwards ſtrain

ſtrain thro' moiſt paper or a filter, ſo as that it may become as clear as poſſible; then put the lee into a glaſs veſſel, and let it remain in *Balneo Mariæ* untill ſuch time as a great part of it evaporates, according to the proportion obſerved by ſuch as are uſed to theſe operations, and as the congelation of the ſalt is deſired to be more or leſs expedited or retarded. 2. If you keep the lee to evaporate by the fire, in glazed veſſels of earth, you will loſe a great quantity of the ſalts, for as the lee grows thick, the ſalt penetrates the bottom and ſides of the veſſels of earth, and is loſt. 3. The quantity of water to make the lee off is not determined, for the moſt part five pounds of water will extract all the ſalt from two pounds of aſhes. 4. The aſhes, whereof you have already made the lee, and out of which you have extracted the ſalt, may, if you burn the ſame in a brick furnace; make another new lee, which uſually yields ſome ſmall portion of ſalt. 5. The ſalts, extracted in the manner aforeſaid, when the air is moiſt, are wont to melt; to obviate this inconveniency, when you burn the materials in order to reduce them to aſhes, it is requiſite to uſe with them a proper quantity of ſulphur; and if it happens that the aſhes are made to your hand, you may mix them with ſulphur, and keep the ſame at the fire, till ſuch time as it be burnt; by this means, the ſalt will never come to run, but become more white and cryſtalline. 6. There is no general rule for the quantity of ſulphur to be put into the materials you thus burn; you may nevertheleſs at a gueſs ſay, to 100 pounds of materials 4 or 5 ounces of ſulphur are uſually ſufficient. 7. All ſalts have a peculiar and determined figure, which they always keep, altho' they are often reſolved into water, and afterwards congealed. 8. If in one only liquid, you diſſolve together two or three ſorts of ſalts of different figures, when they congeal, they all aſſume their ancient and proper figure, and this happens not only in factitious, but alſo in mineral ſalts. If in a veſſel full of water, you diſſolve equal or unequal quantities of vitriol of cyprus, rock allum, and of purified nitre, this water will be all of an azure colour; but when the water is evaporated, you will obſerve in the veſſel, that the vitriol, the allum, and the nitre, have re-aſſumed diſtinctly their firſt figure, and that the vitriol hath recovered its moſt complete azure colour, leaving the nitre and the allum with their uſual tranſparent whiteneſs. 9. Altho' it be ſaid above ¶ 7. that all ſalts have a proper and particular figure, yet notwithſtanding all this, ſome ſorts of ſalts are obſerved to have 2, 3, and 4 ſorts of figures; two ſorts have been ſeen in lettice, in the *Scorzonera*'s, in the muſk-melon, the *Scopa*, in the roots of *Eſula*, in the black hellebore, in endive,

in

in eye-bright, in wormwood, in sorrel, and in shoots of vines; 3 sorts in black pepper, and in incarnate roses; 4 sorts in the white hellebore. 10. Besides the abovementioned diversity of figures which are found in salts, it is observable, that amongst all salts, of what figure soever, there are found some cubical, which, tho' they be never so often dissolved and congealed, appear still of a cubical figure, or inclining to it. 11. S. *Redi* knows not that it is a general rule, that the different parts of herbs, fruits, &c. make a diversity in the figure of their salts; but he says, particularly, that the salts of the leaves of laurel differ from that of the wood, and that the figure of the salt of the pulp of a gourd differs from that of the rind. 12. Many salts of different matter have the same, or at least very like figures; the salt of cucumbers hath a figure like the salt of *Eye-bright*, *Mechoacan*, *Scopa*, and *Lettice*; also all the salt of orange-flowers, roses, ginger, endive, *Colloquintida*, *Scorzonera* root, white hellebore roots and liquorish are all like one another; coleworts and rosemary-flowers yield a salt of one and the same figure, as likewise do among themselves vine-branches, sorrel, black pepper, the rind of pomegranates, and the roots of black hellebore. 13. To make the bodies of the salts, when they congeal, remain distinct from each other, so as that their figures may be observed, and not be entangled and heaped together; it is necessary, that very great diligence be used in evaporating the lee; for if that be wholly evaporated, or too great a part thereof, the salts make a confused crust at the bottom of the vessel; if the lees are left too weak, the salts require a very long time to congeal, and therefore it is requisite to use such diligence as is not to be gained without long practice: The instruments for determining the weights of liquids may give a rule, which if not general, will at least come very near the matter: The lees being reduced to a proper thickness, are put into little small glasses closed with a stopple, and kept in a very dry place, and you may expect that in time the salts will congeal into crystalline shoots, either in the bottom, or on the sides of the vessel. 14. All sorts of herbs, flowers, fruits, or woods, when they are burnt, do not yield equally the same quantity of salt, but according to the diversity of their species, the quantity of salt drawn from their ashes, is found different; the seasons wherein the plants are gathered, occasion a great diversity as also does the country, whether mountainous or champaign, sea-coast, marshy or moist. 15. All bodies burnt, yield not the same quantity of ashes; but there is a great diversity, which you may see by the following proofs:

Vege-

Vegetables.	Ashes.	Salts.	Ashes from 100 *lb.* of Vegetables.	Salts from 1 *lb.* of Ashes.
	lb.	*lb. ou.* ʒ	*ou.* ʒ	*lb. ou.* ʒ ℈ gr	*ou.* ʒ ℈ gr.
Dried flowers of oranges	100	4 6 0	0 5	4 6 0 0 0	0 1 0 8
Gourds now gathered, which dried in the oven were 36 *lb.*	800	4 0 0	10 0	0 6 0 0 0	2 4 0 0
Red onions being 720 roasted, the coals burnt to 16 *lb.* to the coals were added 4 ounces of sulphur	400	1 6 0	2 2	0 4 4 0 0	0 7 1 0
Eye-bright fresh, and afterwards stilled and burnt	150	5 0 0	4 0	3 4 0 0 0	1 1 1 9
Distilled roses	120	4 0 1	0 4	3 4 0 0 0	3 0 0 0
Maidenhair	100	9 0 0	0 0	9 0 0 0 0	0 0 1 8
Roots of black hellebore, which dried came to 50 *lb.*	150	6 0 0	1 0	4 0 0 0 0	0 0 4 0
Roots of white hellebore fresh which dried came to 50 *lb.*	150	2 0 0	4 0	1 4 0 0 0	1 0 0 0
Roots dried and burnt of fresh Esula	96	3 0 0	2 0	3 1 4 0 0	
Roots of liquorish	30	2 0 0	1 4	6 8 0 0 0	0 6 0 0
Pellitory	20	1 0 0	0 6	5 0 0 0 0	0 6 0 0
Green endive	100	2 0 0	2 0	2 0 0 0 0	1 0 0 0
Green bindweed	90	1 0 0	2 0	1 1 2 2 0	2 0 0 0
Leaves of laurel	2000	33 0 4	0 0	1 2 0 0 0	0 3 1 22
Leaves of laurel	500	6 0 0	10 0	1 7 4 2 10	1 5 1 6
Water-melons full ripe the seeds being taken	1000	25 0 1	9 0	2 6 0 0 0	0 6 1 11
Cucumbers	2400	18 0 0	0 0	0 9 0 0 0	
Wood of ivy	300	9 0 0	0 0	3 0 0 0 0	
Scorzonera dried	50	8 0 0	0 0	16 0 0 0 0	
Pine-apples, the nuts taken out	300	3 0 0	0 0	1 0 0 0 0	
Mugwort dried	150	8 0 0	0 0	5 4 0 0 0	
Leaves of cyprus	130	6 0 0	0 0	4 7 3 5 0	
Peel of pomegranates dried	10	1 8 0	0 0	6 8 0 0 0	
Sassafras	2	1 0 0	0 0	3 1 4 0 0	
Lignum sanctum	12	2 6 0	0 0	20 10 0 0 0	
Yellow sanders	4	1 1 4	0 0	1 0 4 0 0	
Black pepper	4	1 2 4	0 0	5 2 4 0 0	
Ginger	30	1 7 0	0 0	5 3 2 2 0	
Turbith	12	1 0 0	0 0	8 4 0 0 0	
Wood of firr		3 0 0	3 0		1 0 0 0
Scopæ		16 0 1	4 0		1 0 0 0
Scopæ		16 0 1	6 0		1 1 0 0
Wheat flower				2 2 5 1 0	

The

The heads of old garlick to 32 pounds were dried in a furnace and burnt, from the aſhes there was hardly any ſalt to be gathered: Thirty pounds of wheat flower burnt in a furnace with a little ſulphur, and burnt a-new in a potter's oven, gave 8 ounces of very black aſhes, which being baked again for 8 days, continually in a brick furnace after the lee was made, there could not be a grain of ſalt drawn from it; the like happened in 10 ounces of aſhes made from a *Stare* and a half of bran, burnt firſt in the furnace with ſulphur, and afterwards baked in a potter's oven, and in one of bricks. 16. All ſalts whatever, drawn from the aſhes of vegetables, taken by the mouth, have a purging faculty, and in a great meaſure more than what is by ſome believed to be in common ſalt, which taken by the mouth has little or none at all, or if it have any, the proportion betwixt that of common ſalt and vegetables, is but as 2 to 8. 17. This ſolutive faculty is of equal energy in all the ſalts, in ſuch a manner that the ſalt of *Sumach*, peel of pomegranates, myrtle-berries or maſtick, purges as much as the ſalt of *Rhubarb*, *Sena*, *Turbith*, *Mechoacan*, and all other ſuch like purgative drugs. 18. The doſe to be uſed is the ſame in all the ſalts, *viz.* from two drachms and a half to half an ounce, diſſolved in ſix ounces of common water and broth: S. *Redi* had obſerved by an infinite number of experiments, that half an ounce is wont to purge three pounds and a half, or four pounds, or thereabouts, of matter, more or leſs, according to the complexions, and according to the fullneſs of the bodies it operates upon. 19. In purging, he found no difference betwixt theſe ſalts that have ſharp points, and thoſe that are obtuſe and blunt, or cubical; he had made frequent trials on divers perſons, cauſing the like cubical ſtones of cucumbers, ginger, colewort, and liquoriſh to be picked out, and he has ſeen, that they wrought with the ſame energy as the moſt acute hexagonal ſtones of the ſalt of pepper, carnation-roſes, mechoacan, coleworts, cucumbers, *&c.* 20. From the above obſervations, tho' you cannot eſtabliſh a certain rule, you may nevertheleſs conjecture, not without ſome reaſon, firſt, that the ſalts drawn from the aſhes of herbs, flowers, fruits, *&c.* do not retain that virtue and faculty which phyſicians believe the herbs, flowers, fruits, *&c.* to be endowed with; ſecondly, you may very nearly be certain of the proportion of aſhes ariſing from each ſpecies of vegetables, and of the quantity of ſalt which is afterwards to be drawn from them. 21. You may alſo obſerve, that ſome vegetables which are inſipid and cold, as endive, pompion, and roſes, have yielded much more ſalt than others of a ſtronger ſavour, more

aperitive and incisive, as onions, hellebore, laurel, maiden-hair, and garlic, which, tho' so strong, give none at all; but perhaps it may be said for this, that in these there is a greater quantity of volatile salt.

The Way of making Pitch, Tar, Rosin, *and* Turpentine; *by Mr.* Tho. Bent. Phil. Trans. N° 243. p. 291.

FIVE leagues from *Marseilles* are very high mountains, for the most part covered with forests of pine-trees, which grow wild; half a league out of the road, you see the making of pitch, tar, rosin, and turpentine, which is thus; in the spring time, when the sap is most plentiful, they pare off the bark of the pine to make it run down into a hole, cut on purpose at the bottom to receive it; as it runs, it leaves a cream or crust behind it, which they take and temper in water, and sell to people for white bees-wax, that they make flambeaus of, and is a great deal dearer; then they take up the juice in spoons from the bottom, and when they have thus got a good quantity, they strain it thro' a grocer's basket, such as they put their *Malaga* raisins in, and that which runs easily through is the common turpentine; then they take what remains in the basket, and adding a sufficient quantity of water, they distil it in an alembic, the liquor so distilled is oil of turpentine, and the calx that remains is common rosin; afterwards they cut the stock of the tree into large chips, and pile them hollow in a cave, covering it a top with tiles, so as that some air may come in to feed the fire; then burning them, there runs down a thick juice to the bottom, where they make a small hole for it to come out at, for too large a hole would set it all in a flame, and the liquor that runs out is tar, then they take that off, and boiling it gently over again, to consume more of the moisture, they set it to cool, which when cold is pitch.

Of Rusma *and* Alcanna; *by Mr.* Smith. Phil. Trans. N° 243. p. 295.

THIS black earth, which is called *Rusma*, and looks as if it were burnt, must be pounded in an iron or marble mortar to a fine powder, and carefully sifted; when you use it, take one part of the said powder and two parts of unslacked lime, which when mixed together, put into a linen rag, and infuse it in warm water for the space of a quarter of an hour, or till it becomes of a black colour, then apply it to the place from whence you would take the hair, and as soon as the hair begins

begins to be loose, the part must be washed with warm water and soap.

Alcanna is the leaf of a plant, dried and powdered, which when steeped a night in wine will dye the nails red.

To give Iron *a* Copper Colour; *by Sir* Robert Southwell. Phil. Transf. N° 243. p. 295.

TAKE of small thin copper pieces, cleaned in the fire, one ounce, of *Aqua-fortis* three ounces, which being put together in a glass, the copper will be dissolved in three or four hours; when it is cold, you may use it, by washing it with a feather upon the iron, made clean and smooth, which will presently take the colour of copper; when it comes off by rubbing, renew it again; but if you do it twice together, the iron will look black.

To gild Gold *upon* Silver; *by the Same.* Phil. Transf. N° 243. p. 296.

BEAT a ducat thin, and dissolve it in two ounces of *Aqua Regia*, then dip a clean rag in it, and let the same dry, and do it over and over untill all the liquor is soaked up, then burn the rag, and with the tinder of it rub the silver over, using a little spittle with it, and if it happens that the silver will not take, hold it to the fire, to dry off the grease, and then it will have the desir'd effect.

The strange Effects reported of the ancient Musick *examined; by Dr.* Wallis. Phil. Transf. N° 243. p. 297.

1. THE Doctor takes it for granted, that much of the reports concerning the great effects of musick in former times, beyond what is to be found in latter ages, is highly hyperbolical, and next door to fabulous, wherefore, he thinks, great abatements must be allowed to its elogies. 2. We must consider, that musick to any tolerable degree was then, if not a new, at least a rare thing, which the rude people, on whom it is reported to have had such extraordinary effects, had never heard before, and upon such a little musick will do great feats; as we find at this day a fiddle or a bag-pipe at a country morrice dance. 3. We are to consider, that their musick, even after it came to some degree of perfection, was much more plain and simple than our's now a-days; they had not consorts of two, three, four, or more parts or voices, but one single instrument, or single voice at a time, which to a rude ear is much

much more taking than more compounded muſick; for that is at a pitch not above their capacity, whereas this other confounds them, as it were, with a great noiſe, in which they can diſtinguiſh nothing of harmony. 4. We are to conſider, that muſick with the ancients was of a larger extent than what we call muſic now-a-days; for poetry, and dancing, or a becoming motion, were then accounted parts of muſick, when muſick arrived to ſome perfection; now we know that verſe of itſelf, if in good meaſure, or cadence, and affectionate language, and ſet to a muſical tune, and ſung by a good voice, and accompanied but with ſoft inſtrumental muſick, ſo as not to drown or obſcure the emphatic expreſſions, like what we call recitative muſick, will work ſtrangely upon the ear, and move all the affections ſuitable to the tune and ditty, whether briſk and p'eaſant, or ſoft and pitiful, fierce and angry, or moderate and ſedate, eſpecially if it be attended with a becoming geſture and action; for it is well known, that ſuitable action on a ſtage gives a great deal of life to the words ſpoken: Now all theſe together, which were ingredients in what they called muſick, muſt needs operate ſtrongly on the fancies and affections of ordinary people, unacquainted with ſuch kind of entertainments; for if the deliberate reading of a romance, when well penned, will produce mirth, tears, joy, grief, pity, wrath or indignation, ſuitable to the ſeveral intents thereof, much more would it produce theſe effects, if accompanied with all thoſe circumſtances. 5. It will perhaps be aſked, why may not all this be now done, as well as then? In anſwer to this, no doubt it may, and with a like effect, if an addreſs be made to the paſſions in proper words, with moving accents in juſt meaſures, either poetical or rhetorical, with the emphatic words ſet in ſignal places, pronounced with a good voice and a true accent, and attended with a becoming geſture: All theſe ſuitably adjuſted to the paſſion, affection, or temper of mind, particularly deſigned to be produced, be it joy, love, grief, pity, courage, or indignation, will certainly now, as well as then, produce great effects upon the mind, eſpecially upon a ſurprize, and where perſons are not otherwiſe pre-engaged; and if ſo managed, as that you be, or ſeem to be in earneſt, and if you do not over-act by an apparent affectation. 6. We are to conſider, that the uſual deſign of what we now call muſick, is very different from that of the ancients; for what we now call *Muſick*, is but what they called *Harmonic*, which was but one part of their muſick, conſiſting of words, verſe, voice, tune, inſtrument and action, and thus we are not to expect the ſame

effect

effect of one piece, as of the whole. 7. When music was arrived to a great perfection, it was applied to particular designs of exciting this or that particular affection, passion or temper of mind, its tunes and measures being suitably adapted to such designs; but such designs seem almost quite neglected in our present music, for the chief scope now in our most accomplished music is to please the ear, when by a sweet mixture of different parts and voices, with cadence and concord intermixed, a grateful sound is produced, which the judicious musician alone can discern and distinguish. 8. It is true, that even this compound music admits of different characters; some are more brisk and airy, others more sedate and grave, others more languid, as the different subjects require: But that which is most proper to excite particular passions or dispositions, is such as is most simple and uncompounded; such as a nurse's languid tune, lulling her babe to sleep, or a continual reading in an even tone, or even the soft murmur of a little rivulet, running upon gravel or pebbles, incline to a quiet repose of the spirits; and contrariwise the briskness of a jigg on a kit or violin, excites to dance, and these are more operative towards such particular ends than an elaborate composition of full music. 9. To conclude, if we aim only at pleasing the ear by a sweet concert, no doubt but our modern compositions may equal, if not exceed, those of the ancients; amongst which there is not found any footsteeps of what we call several parts or voices, as *base*, *treble*, *mean*, &c. sung in concert, answering each other, to complete the music: But if we would have our music so adjusted, as to excite particular passions, affections or tempers of mind, as that of the ancients is supposed to have done, we must apply more simple ingredients, fitted to the temper we would produce; and this no doubt but a judicious composer may so effect, that without the help of such hyperboles, as the ancient music is wont to be set off with, ours may be made to perform as great feats as any of theirs.

A Roman Coffin *and other* Roman *Antiquities and* Coins; *by Mr.* Ralph Thoresby. Phil. Transf. N° 244. p. 310.

MR. *Thoresby* procured part of the bottom (which consisted of several pieces for the conveniency of baking) of an old *Roman* coffin, that was dug up in their burying ground out of *Boutham-bar* at *York*; it is of the red clay, but not so fine as the urns, having a greater quantity of the coarse sand wrought in with the clay; as to the form, which is entire as it was at first moulded, it is 14 inches and a half long and about 11 broad at the

the narroweſt end, and nigh 12 and an half at the broadeſt; this was the loweſt part for the feet, and the reſt was proportionably broader till it came to the ſhoulders; it is an inch thick beſides the ledges, which are one inch broad and two thick, and extend from the bottom of either ſide to within three inches of the top, where it is altogether flat and ſomewhat thinner for the next to lie upon it; the ſeveral parts whereof were thus joined together by pins, as may be preſumed; for at the end of each tile is a hole, that would receive a common ſlate pin; theſe edges are wrought a little hollow, probably, to receive the ſides, and at the feet are two contrary notches to faſten the end piece: This bottom might be concluded to have conſiſted ſtrictly of eight ſuch parts, from the character eight ſtamped upon the clay by the *Sandapilarius*'s (i. e. ſexton's) finger before its baking, but that it is ſomewhat doubtful whether numeral characters be of that antiquity in theſe *European* parts. Mr. *Thoresby* had ſome ſcrapes of broken urns, of a very fine clay, with which was found a *Roman* ſhuttle, about three inches and a half long, but not one inch broad in the very middle; the hollow for the *Licium* or thread being but one fourth of an inch in the broadeſt place, ſhews that it was either for ſilk or very fine linnen, perhaps for their *Asbeſtinum* or incombuſtible cloth. He alſo procured a *Roman* pottle from *Alborough*, which is of the red clay, but much coarſer than the *York* urns, which he took to be ſtrictly the half of their *Congius*, and comes the nigheſt to Mr. *Greaves* computation, containing three pints and an half *Wincheſter* meaſure. He received 22 old *Roman* coins from Mr. *Townley* of *Townley*, which were found in the pariſh of *Burnley* in *Lancaſhire*; many of them were conſular, or family coins, one of them, *viz.* Q. *Caſſius* was 162 years before Chriſt, according to *Goltzius*'s method, being ſtrictly the ſame he makes *A. U. C.* 589. That they were the ancient *Roman Denarii*, and coined before the emperor's times, notwithſtanding the contrary ſentiments of ſome learned men, is evident, becauſe there is moſtly inſtead of the emperor's head, the antique form of the city's head, without an inſcription; beſides *Tacitus* calls theſe *bigati* and *quadrigati*, *pecuniam veterem ac diu notam*, i. e. coins having the image of a chariot drawn by two and by four horſes, as ancient and long known. Again, others have upon them ROMA, which is not uſed by any of the emperors, except thoſe ſmall pieces that were coined upon the tranſlation of the empire to *Conſtantinople*; again, the letters in theſe are often interwoven, as particularly V—L in one Mr. *Thoresby* had of *L. Valerius Flaccus A. U. C.* CDXCII.

CDXCII. which according to *Goltzius* is the 7th year after the *Romans* firſt began to ſtamp ſilver money; and to mention no more, many are filed in ſmall notches round the edge, of which ſort Mr. *Thoresby* had ſome of *Scipio Aſiaticus*, &c. and other conſular pieces, but he never ſaw any of a later date.

The Symptoms attending the Bite of a Serpent; *by Mr.* Aar. Goodyear. Phil. Tranſ. N° 245. p. 351.

MR. *Robert Burdett* an *Engliſh* merchant at *Aleppo* was bit by a ſerpent on the left wriſt, near the pulſe towards his hand; it ſeemed at firſt like two pricks of a pin, he immediately vomited, and his wriſt and hand began to ſwell, he had ſome few days before a looſeneſs, which perhaps this increaſed; he rode eaſily after he was bit about two miles from home, he ſaid he felt no pain, but had a great deſire to ſleep, his arm continued ſwelling upwards and grew black; ſome few remedies were applied, and his arm was cupped and ſcarified, he continued ſtill without pain, but was very drowſy; at laſt the ſwelling came up to his ſhoulder, and then he complained much, and within a quarter of an hour he died: He was bit about 10 in the forenoon and died about 3 in the afternoon; his body ſwelled much after he was dead, and purged: The ſnake was like a common ſnake for length, of a dark ſandy colour with black ſpots; his two teeth, or fangs were like thoſe of a rattle-ſnake on the upper jaw; the poiſon lies in the gums, and wherever they fetch blood of any creature they certainly kill, tho' in ſome parts ſooner than in others: The people of the country ſay, that if, as ſoon as one is bit by a ſerpent, he immediately ſucks the wound, he may be ſaved; but he muſt firſt rub his gums and teeth with oil, that none of the poiſon may touch any place where the ſkin is broken, and immediately ſpit out what he has ſucked, every time waſhing his mouth, and taking more oil. This ſerpent killed a dog in about 8 minutes time, biting him at the end of his ear; and two young turkeys afterwards in 3 or 4 minutes each, biting them at the end of a claw; then poiſoning the ſnake with the oil of tobacco out of a reed-pipe, that had been much uſed and not cleanſed for a week or two, it died in about two or three minutes, trembling as ſoon as the oil was thrown into its mouth.

A Me-

A Method of inſtructing Perſons Deaf *and* Dumb *to ſpeak, and underſtand a Language; by Dr.* Wallis. Phil. Tranſ. N° 245. p. 353.

IN order to teach a deaf perſon a language, it is neceſſary in the firſt place that he be taught to write, that ſo there may be ſomewhat to expreſs to the eye what the ſound of the letters repreſents to the ear: It will next be very convenient, becauſe pen and ink are not always at hand, that he be taught how to deſign each letter by ſome certain place, poſition or motion of a finger, hand or other part of the body, which may ſerve inſtead of writing; as for inſtance the five vowels *a*, *e*, *i*, *o*, *u*, by pointing to the top of the five fingers; and the other letters *b*, *c*, *d*, &c. by ſuch other place or poſture of a finger as ſhall be agreed upon. After this a language is to be taught the deaf perſon, by ſuch like methods as children are at firſt taught, tho' the thing perhaps is not much heeded; only with this difference, children learn ſounds by the ear, but the deaf perſon is to learn the marks of thoſe ſounds by the eye; but both the one and the other do equally ſignify the ſame thing, or notion, and are equally of mere arbitrary ſignification. It is then moſt natural, as children learn the names of things, to furniſh them by degrees with a *Nomenclator*, containing a competent number of names of things common and obvious to the eye, that you may ſhew the thing anſwering to ſuch a name; and theſe are to be digeſted under proper titles, and placed under them in ſuch order, in ſeveral columns or other regular ſituation in the paper, as by their poſition may beſt expreſs to the eye their relation or reſpect to each other; as contraries or correlatives, one over againſt the other, ſubordinates or appurtenances under their principals, which may ſerve as a kind of local memory; thus in one paper under the title *Mankind* may be regularly p'aced, *man*, *woman*, *child*, &c. and if you pleaſe the names of ſome known perſons, with ſpaces left to be ſupplied with other like names or words, as afterwards there may be occaſion for; then in another paper under the title body may be written, in the like proper order, the parts of the body, as head, hair, ſkin, ear, face, neck, breaſt, belly, &c. with like vacant ſpaces as before, for more to be added as there is occaſion: And when he hath learned the import of words in each paper, let him write them in like manner in diſtinct leaves or pages of a book, prepared for that purpoſe, in order to confirm his memory, and to have recourſe to it upon any occaſion. In a third paper you may inſtruct him in the inward parts, as the ſkull,

ſcull, throat, ſtomach, heart, lungs, &c. In another paper, under the title *Beaſt* may be placed the ſeveral kinds of beaſts, as horſe, cow, ſheep, hog, dog, hare, &c. under the title *Bird* or *Fowl* the ſeveral kinds of birds, as hen, duck, gooſe, kite, lark, &c. under the title *Fiſh*, put pike, eel, plaice, ſalmon, lobſter, &c. You may then put plants or vegetables under ſeveral heads or ſubdiviſions of the ſame head, as trees, fruits, flowers, herbs, corn, &c. And the like of inanimates, as heaven, ſun, moon, ſtars, elements, earth, metals, minerals, waters, air, meteors, fire, &c. Under the title *Cloaths* put the ſeveral ſorts, both woollen, linen, &c. and under the title *Houſe*, *Room*, &c. the parts, furniture and utenſils thereunto belonging, with diviſions and ſubdiviſions as there is occaſion; and in like manner may be added from time to time more collections or claſſes of names or words, properly digeſted under diſtinct heads and ſuitable diſtributions, to be written in diſtinct leaves or pages of his book, in ſuch order as may ſeem moſt convenient. When he is furniſhed with a competent number of names, it will then be time to teach him under the titles *ſingular* and *plural*, the formation of plurals from ſingulars, by adding *s* or *es*, hand, hands, face, faces, fiſh, fiſhes, &c. with ſome few irregulars, as man, men, woman, women, foot, feet, mouſe, mice, ox, oxen, &c. which, will ſerve for *poſſeſſives*, to be afterwards taught him, that are formed from their primitives, by the like addition of *s* or *es*, except ſome few irregulars; as my, mine, thy, thine, our, ours, &c. and in all thoſe and other the like caſes it will be proper firſt to ſhew him the particulars, and then the general title: Then teach him in another page or paper the *Particles*, as a, the, theſe, &c. and the *Pronouns*, as I, thou, he, they, who, &c. then under *Adjective*, *Subſtantive*, teach him to connect theſe, as my hand, your head, their ſhoes, &c. To furniſh him with more adjectives, under the title *Colours*, you may place black, white, grey, &c. and having ſhewed the particulars, let him know theſe are called colours; the like for taſte, ſmell, hearing, and touch or feeling; from whence you may furniſh him with examples of adjectives with ſubſtantives, as white bread, ſoft cheeſe, my black hat, &c. And then inverting the order, ſubſtantive and adjective with the verb copulative between, as ſilver is white, gold is yellow, lead is heavy, I am not well, &c. which will give him ſome notion of ſyntax: In like manner, when ſubſtantive and ſubſtantive are connected, as gold is a metal; a roſe is a flower; larks are birds, &c. then as thoſe before relate to quality, you may give him ſome other words relating

lating to quantity; as long, ſhort, broad, many, full, &c. Then words of figure, as ſtraight, round, concave, convex, &c. Of geſture, as ſtand, ſit, &c. of motion, as move, run, fly, creep, &c. then words relating to time, place, number, weight, meaſure, money, &c. are in proper time to be ſhewed him diſtinctly; as likewiſe the names and ſituations of places and countries, which are convenient for him to know, which may be written regularly in his book, and ſhewed him in maps, &c. After the concord of ſubſtantive and adjective, he is to be ſhewed by proper examples that of the nominative and verb, as for inſtance, I go, he ſits, the fire burns; with the titles on the top, *Nominative*, *Verb*; after this under the titles nominative, verb, accuſative, give him examples of verbs tranſitive; as, you ſee me, the fire burns the wood; or even with a double accuſative, as, you teach me writing, or to write. After this you may teach him the flexion or conjugation of a verb, or what is equivalent thereunto; for in the *Engliſh* tongue each verb hath but two tenſes, the preſent and the preterperfect, and two participles the active and the paſſive, all the reſt is formed by auxiliaries, which have no more tenſes than the other verbs; thoſe auxiliaries are, do, did, will, would, ſhall, ſhould, may, might, can, could, muſt, ought to, have, had, am, be, was; and if by examples you can inſinuate the ſignification of theſe few words, you will then have taught him the whole flexion of the verb; and here it will be proper once for all to write him out a full ſpecimen of ſome verb, ſuppoſe to *ſee*, thro' all thoſe auxiliaries; the verb itſelf hath but theſe four words to be learned, ſee, ſaw, ſeeing, ſeen, except that, after thou in the ſecond perſon ſingular in both tenſes, we add *eſt*, and in the third perſon ſingular of the preſent tenſe *eth* or *es*, or inſtead thereof *ſt*, *th*, *s*, and ſo in all verbs; then to the auxiliaries, do, did, will, would, ſhall, ſhould, may, might, can, could, muſt, ought to, we adjoin the indefinite *ſee*; and after have, had, am, be, was, the paſſive participle ſeen, and ſo for all other verbs. But the auxiliary *am* or *be* is ſomewhat irregular, am, art, is, in the ſingular and *are* in the plural; waſt, was, in the ſingular, and were in the plural; be, beeſt, in the ſingular, *be* in the plural; were, wert ſingular, and were plural: Be, am, was, being, been; which attended with the other auxiliaries, make up the whole paſſive voice. All verbs without exception in the participle active, are formed by adding *ing*, as, ſee, ſeeing, teach, teaching, &c. the preter tenſe and the participle paſſive are formed regularly by adding *ed*, but are often ſubject to contractions and other irregularities of that kind, ſometimes the ſame in both,

both, ſometimes different; and therefore it is proper here to give a table of verbs, eſpecially the moſt uſual, for thoſe three caſes, which may at once teach their ſignification and their formation, as boil, boiled, boiled, bake, baked, baked, &c. teach, taught, taught, buy, bought, bought, &c. give, gave, given; write, wrote, written, &c.

Having thus diſpatched the verbs, he is then to learn the prepoſitions, wherein lies the whole *regimen* of the noun; for, diverſity of caſes we have none, the force of which is to be inſinuated by proper examples, ſuited to their different ſignifications, as for inſtance; *of*, a piece of bread; a cup of water; a pint of wine, &c. and in like manner, off, on, to, from, at, in, by, &c. and by this time he will be pretty well enabled to underſtand a ſingle ſentence. In the laſt place, he is in like manner to be taught conjunctions, that ſerve to connect not only words but ſentences; as, and, if, but, becauſe, therefore, &c. and theſe to be illuſtrated to him by examples; as, becauſe I am cold, therefore I go to the fire, that I may be warm; for it is cold weather. By this time his book, if well furniſhed with plenty of words and thoſe well digeſted under ſeveral heads and in proper order, and well recruited from time to time, as new words occur, will ſerve him in the nature both of a dictionary and grammar: And in caſe the deaf perſon be otherwiſe of a good natural capacity and the teacher of good ſagacity, by this method proceeding gradually ſtep by ſtep, you may with diligence and a due application of teacher and learner, in a year's time or thereabouts perceive a greater progreſs than you could expect, and thereby a good foundation laid for further inſtruction in matters of religion and other knowledge, which may be taught by books. It will be convenient all along to have pen, ink and paper at hand, to write down in words what you ſignify to him by ſigns, and cauſe him to write, or ſhew him how to write whatever he means by ſigns; which way of ſignifying their minds by ſigns, deaf perſons are often very good at; and we muſt endeavour to learn their language, if I may ſo call it, in order to teach them ours, by ſhewing what words anſwer to their ſigns: It will alſo be proper, as you go on, after ſome convenient progreſs made, to expreſs in as plain language as may be, the import of ſome of the tables; as for inſtance, the head is the higheſt part of the body; the feet the loweſt part, the forehead is over the eyes, &c. and ſuch plain diſcourſe, put into writing and particularly explained, will teach him by degrees to underſtand plain ſentences: And ſuch like advantages a ſagacious teacher may take, as occaſion offers. This

method Dr. *Wallis* uſed with good ſucceſs in teaching Mr. *Alexander Popham*, who was born deaf, to ſpeak diſtinctly and to underſtand a language, ſo as to expreſs his mind tolerably well in writing, and underſtand what was written to him by others, as he had before taught Mr. *Daniel Whaley*.

Obſervations in New Holland; *by M.* Witſen. Phil. Tranſ. N° 245. p. 361.

IN a voyage to the *South land*, called *Hollandia Nova*, it has been diſcovered that the ſoil of the country is very barren and like a deſart; no freſh-water rivers have been found, but ſome ſalt-water ones; as alſo no four-footed beaſts, except one as great as a dog, with long ears, that lives in the water as well as on the land: Black-ſwans, parrots and many ſea-cows were found there, as alſo a lake, whoſe water ſeemed to be red, becauſe of the redneſs of its bottom, and along the ſhore there was ſome ſalt; our people ſaw but 12 of the natives, all as black as pitch and ſtark naked, who were ſo much affrighted at ſeeing of them that they could not be brought to a converſation or a meeting; they lodge themſelves, as the *Hottentots* do, in pavillions made of ſmall branches of trees: By night the people ſaw fires all over the country, but when they drew near, the natives were fled; the coaſt is very low, but the country diſtant from the ſea is high: Upon the iſland near the coaſt were ſeen rats as large as cats in great numbers, all which had a kind of a bag or purſe hanging from the throat upon the breaſt downwards; there were found many ſweet ſcented trees, out of the wood of which may be drawn oil ſmelling like a roſe, but for the reſt they were ſmall mean trees, there were alſo found ſome birds neſts of a prodigious bigneſs, ſo that ſix men could not, by ſtretching out their arms fathom one of them, but the fowls were not to be found; there was great ſtore of oyſters, lobſters and crabs; as alſo of ſtrange ſorts of fiſh; there were alſo infinite numbers of flies which are very troubleſome; they ſaw a great many footſteps of men and children, but all of an ordinary bigneſs; the coaſt is dangerous and full of rocks.

To make the Globe Looking-Glaſs; *by Sir* Rob. Southwell. Phil. Tranſ. N° 245. p. 363.

TAKE quickſilver, marcaſite of ſilver, of each three ounces, tin and lead, of each half an ounce, theſe two throw firſt upon the marcaſite and laſt of all the quickſilver; ſtir them well together; but they muſt be taken from the fire, and towards cooling, before the quickſilver be added, let your glaſs

glaſs be well warmed, then pour in the mixture, and roll it from ſide to ſide.

Note, this will alſo do when cold, but it is beſt when the glaſs is heated and very dry.

Note alſo, that if your ball be of yellow glaſs, then all will ſhine like gold.

To paint Glaſs *with* Marble Colours; *by Sir* Robert Southwell. Phil. Tranſ. N° 245. p. 364.

1. GRIND well upon a ſtone ſome *Minium* for red. 2. *Radix Curcumæ*, or rather *Ceruſſa Citrina* for yellow. 3. Smalt for blue. 4. Verdegreaſe for green. 5. *Ceruſſa*, or chalk, for white; which being all ſeparately wrought in oil, take a bruſh of hog's hair dipped in any of the ſaid colours, and it will, being rolled in your hand, ſcatter the ſame upon the glaſs; then with your pencil work them together as you think fit; and laſtly, fling a little mead amongſt them, which covers all.

The Magic-lantern *improved*; *by the Same*. Phil. Tranſ. N° 245. p. 364.

THERE are made every where of theſe lanterns to repreſent and magnify figures upon a wall, but then it is only in the dark; wherefore, to give variety of colours, take oil of ſpike, and therein mix the ſeveral colours, wherewith you would have your glaſs to be ſtained; paint them finely on, they preſently dry, and penetrate any glaſs.

The Phoſphorus metallorum; *by the Same*. Phil. Tranſ. N° 245. p. 365.

TAKE *Lapis Smaragdi mineralis*, ſuch as is found in the mines of *Saxony*, and beat it into a very fine powder; if you ſtrew this very thin on any metal, and in any figure, and ſet the plate on hot coals, in a little time you will perceive a light to ſhine in the dark, which will laſt as long as you continue the hot coals; and if you put out the fire, it may do again for once or twice; but then the virtue will fade.

Mineral Waters *at* Eglingham *in* Northumberland; *by Dr.* Cay. Phil. Tranſ. N° 245. p. 365.

THE Doctor had a mineral water ſent him from *Eglingham*, which he found turned almoſt quite as black as if galls were put into it, tho' it had been brought at leaſt 30 miles by land-carriage; after he had ſlowly evaporated in a glaſs more

more than one half of this water, it ſtill retained the ſame black quality, and ſtruck as deep with galls as ever, and at laſt it yielded him a real and genuine vitriol. The oker which this water let fall in very great plenty, he did not much mind, being a thing common to all ink-like waters. The Doctor was ſurpriſed at this phænomenon, and could not bring himſelf to think it poſſible, that the *Pyrites* lying conſtantly under water, ſhould ever yield vitriol, and he knew of nothing elſe, at leaſt in *England*, that it could be obtained from. But having an opportunity to viſit this notable well, he found out that this vitriol water, was what run thro' a drift made for the draining of a row of old wrought coal-pits a little above, and was informed by ſome old men, that formerly wrought in theſe pits, that there was plenty of the *Pyrites* there, by them called braſs-lumps; and that this drift was ſometimes dry, and ſometimes run with a plentiful ſtream; which is as probable an account how this water comes to have vitriol in it, as any one may expect.

The Gall-Bee; *by Mr.* Benj. Allen. Phil. Tranſ. N° 245. p. 375.

IN ſome *Aleppo* galls, which the inſects had not eat their way thro', Mr. *Allen* found a ſort of bee, reſembling our ſmall ſort of wild bees, they have long wings, a deep belly, and on the back, near the commiſſure, to the body, it is of a greeniſh black, the reſt reddiſh, near a cinnamon colour: Theſe galls are very gummy, and ſome of them had a ſtem, and the cavity round them was ſo extremely gummy, that not the leaſt entrance to it appeared, tho' the bee was beginning to make its way out; and from this it may appear, that the atmoſpherical air is not neceſſary to the eſſence of life, before the organs of the body are employed; but that it is maintained by a ſubtiler air, that pervades the more minute pores, as it is conveyed to fiſh thro' the water: Mr. *Allen* alſo found in the greyer ſort of galls, that are not ſo rich in gum, a ſmall *Ichneumon* of a bright green.

The Death-watch; *by Mr.* Benj. Allen. Phil. Tranſ. N° 245. p. 376.

MR. *Allen* traced a death-watch by the noiſe, and found it in a copper-body, that reſembled dried dirt in colour: He found another on a rotten poſt; this ſmall bettle had another that anſwered it in the ſame room, and after a minute's diſtinct

PLATE. IX.

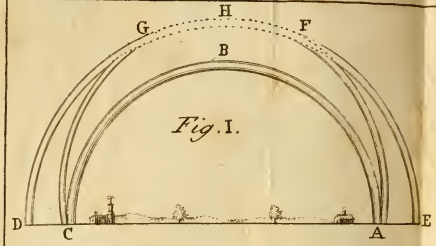


Fig. I.

Fig. II.

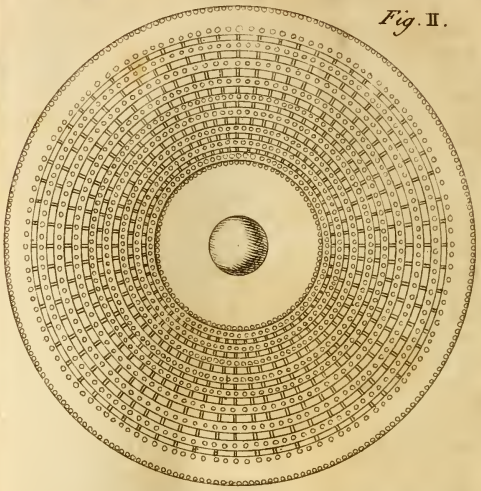


Fig. IV.

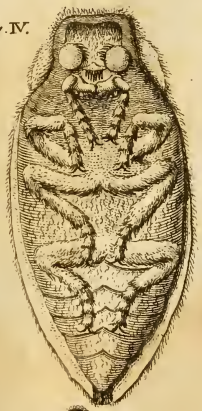


Fig. III.

D *Fig.* V. *p.* 314. B C

A

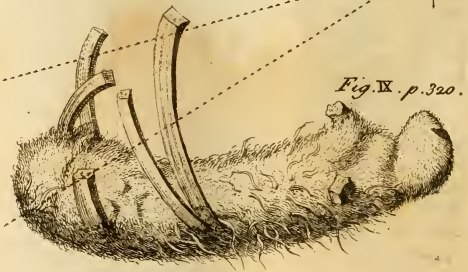


Fig. IX. *p.* 320.

E

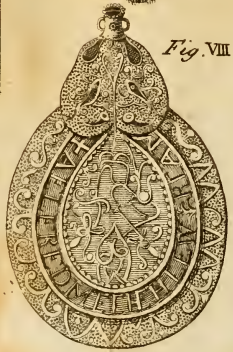


Fig. VIII.

A

Fig. VI.

Fig. VII.

B C

distinct beating, would forbear for the other to answer; the part it beats with is the extreme edge of the face, which may be called the upper lip, the mouth being protracted by this bony part, and lying underneath out of view; it was $\frac{5}{6}$ of an inch long, the colour a dark brown, with spots somewhat lighter, irregularly placed, which would not readily rub off; they seemed to lie rather athwart the back, and directly on the head, as in Fig. 3. Plate IX. which is much of the same size with it, where the *Maculæ* are designed for the greyish spots; under the *Vaginæ* are pellucid wings, and the body is of a dark colour; the head appeared large, by reason of a large cap or helmet, which covered it round, only turned up a little at the ear, from under this appeared the head, which was flat and thin, the eyes forwards, the lip hard and shining, the bars of the helmet greyish; two *Antennæ* proceeded from under the eyes, which by their meeting on the breast, Mr. *Allen* conjectured was to assist their feeding, and were rather *Probosces*; and that the helmet was turned up for the sake of hearing, and the belly plicated like other beetles: The other beetle, that answered it, was less, and the marks on the back not so distinct: By the microscope, he discovered the marks to be spots of hair thick set, of a castor colour; the head all hairy, and the face thick of curled hair; on the belly was a little hair, but thin set; the eyes appeared large as in Fig. 4. the superficies consisting of many small squares furrowed deep between, and these lay in lines descending transversly towards the nose; these eyes were not moveable, but contiguous to the face, without any cavity to receive them, and they were very opaque; the *Antennæ* proceeded from under the eyes, the first large joint having a cavity, out of which it proceeds at the sides of the lip; between the eyes, the face rises in a little ridge, which is the nose, and is signified by the light part of the face; and just below it, the nostrils are covered by straight pendulous hair, proceeding from the lower ridge of the nose; under this hair the cavity is dark, below the nose, the lip-shades shew the more depress places; under this lip are four visible *Forcipes*, two of each side to lay hold on its food.

An

An Eruption of Fire *near* Fierenzola; *by Dr.* Rob. St. Clair. Phil. Tranſ. N° 245. p. 378.

DR. *St. Clair* received an account from his brother, that on the ſide of one of the *Appenine* mountains, half way betwixt *Bologna* and *Florence*, near a place called *Petra mala*, about five miles from *Fierenzola*, there is a ſpot of ground about three or four miles diameter, which inceſſantly ſends up a flame riſing very high, without noiſe, ſmoak, or ſmell, yet it gives a very great heat, and it has been obſerved to be thus at all times, except when great rains fell, which put it out for a time; but when it is over, it burns with greater vigour and heat than before; the ſand about it, when turned up, ſends forth a flame; but within three or four yards of it, there grows corn all round about, for it continues always in the ſame ſpot: The flame ſeems to proceed from a vein of *Bitumen* or *Naphtha*, that crops, as the miners call it, only here; which, when by plowing, or ſome other accident, the upper cruſt has been turned up, was kindled into a flame, by the heat and agitation of the air, as other ſalino-ſulphureous bodies are, of which Mr. *Boyle*'s phoſphorus is a particular inſtance, the like ſpontaneous accenſion is ſeen in many mineral ſubſtances, but none that I know of, ſo quick in its production, or ſo laſting, as this is; the whole woods and fields around having been deſtroyed by it; the neighbours there have been ſo little curious to obſerve it, that they believed there was a great hole in the place the flame proceeded from; but the Doctor's brother found it to be firm ground; neither does any there remember, when, and upon what occaſion it firſt began: The flaming well near *Wigan* ſeems to proceed from a cauſe much like this, in which you may boil an egg, and upon the approach of a lighted candle, it takes fire; both ſeem to proceed from a *Naphtha*, or ſubtile *Bitumen*, only that is in a hotter country, and in a dryer ſoil, is more ſubtile and inflammable; juſt as the *Petroleum* (rock oil) which is found in *Italy*, is a white like ſpirit of turpentine, and is more penetrating than the *Petroleum* which is found in more northern countries; an inſtance of which we have in a well two miles diſtant from *Edinburg*, called the *Baulme well*, of a blackiſh-red colour, and very thick; but being diſtilled, does in colour, taſte, and ſmell, reſemble that of *Italy:* The ſpontaneous accenſion of the *Naphtha* ſeems to be made out by the ſmell our *Bitumen* near *Edinburg* yields, being almoſt like coal-

coal-ſmoak; there are three ſuch fires on the ſame hills that are extinguiſhed in the ſummer, but burn in the winter; the reaſon of which the Doctor judged to be thus, that the bowels of the earth being cooler in the ſummer than in the winter, do not ſend forth that quantity of thoſe ſubtile exhalations, as may be ſufficient to maintain a flame in ſummer; but in winter the bowels of the earth being hotter, which is evident by the ſmoaking of ſprings in winter and not in ſummer, and from the experience of miners, when greater plenty of ſteams are ſent forth, which are agitated in the air into a flame, the briſk motion of the parts, one againſt another, being promoted by the ſubtility and briſk agitation of the aerial particles, that mutually aſſiſt each other.

A new Lamp; *by Dr.* Rob. St. Clair. Phil. Tranſ. N° 245. p. 380.

LET a lamp, made two or three inches deep, with a pipe coming from the bottom, almoſt as high as the top of the veſſel, be filled firſt with water, ſo high as to cover the hole of the pipe at the bottom, to the end the oil may not get in at the pipe, and ſo be loſt; then let the oil be poured in, ſo as to fill the veſſel almoſt brim-full, which muſt have a cover pierced with ſo many holes as there are deſigned to be wicks; when the veſſel is thus filled, and the wicks are lighted, if water fall in by drops at the pipe, it will keep the oil always at the ſame height, or very near it, the weight of water to that of oil being, according to *Kircher*'s table, as 20 $1\frac{8}{9}$ is to 19, which in two or three inches will make no conſiderable difference; if the water runs faſter than the oil waſtes, it will only run over at the top of the pipe; what does not run over, will come under the oil, and keep it to the ſame height.

Experiments about Freezing; *by M.* Des Maſters. Phil. Tranſ. N° 245. p. 384.

A Tube of $\frac{1}{4}$ of an inch diameter, being filled with water to the height of 2 inches, and ſet to freeze in a mixture of ſnow and ſalt, the water when perfectly frozen, appeared $1\frac{1}{6}$ of an inch above the mark it ſtood at before freezing: Another tube of almoſt an inch diameter, being filled with water to the height of 6 inches, and ſet to freeze as before, roſe $\frac{7}{8}$ of an inch above the mark; the water made uſe of, was a ſort of rough pump water, which, according to what trials had been made with it, did, upon the effuſion of oil of tartar

per Deliquium, immediately turn milky and muddy; and the ice of this water was a ſort of very rarified white ice: The tube of almoſt an inch diameter being filled to the height of 6 inches as before, with river water, which would readily mix with oil of tartar, without the leaſt precipitation, and ſet to freeze in a mixture of ſnow and ſalt, it gained but $\frac{5}{8}$ of an inch after it was frozen, whereas the pump-water got $\frac{7}{8}$ of an inch; it was obſervable, that when the water in all theſe experiments began to freeze, a great many ſmall bubbles continually roſe from the bottom: A tube being filled with boiled pump-water to the height of ſix inches, and ſet to freeze as before, it roſe hardly to $\frac{4}{8}$ of an inch above the mark, when the ſame water unboiled roſe to $\frac{7}{8}$.

Prognoſtics of Hurricanes; *by Capt.* Langford. Phil. Tranſ. N° 246. p. 407.

IT hath been the cuſtom of the *Engliſh* and *French* inhabitants of the *Caribbee* iſlands to ſend in, about the month of *June*, to the native *Caribbees* of *Dominico* and St. *Vincent*, to know whether there would be any hurricanes that year; and about 10 or 12 days before the hurricane came, the natives conſtantly ſent them word, and it very ſeldom or ever failed; from one of theſe *Indians*, Capt. *Langford* had the follo ing prognoſtics; 1. All hurricanes come either on the day of the full, change, or quarter of the moon. 2. If it will come on the full-moon, you being in the change, then obſerve theſe ſigns; that day you will ſee the ſkies very turbulent, the ſun more red than at other times, a great calm, and the hills clear of clouds, or fogs over them, which in the highlands are ſeldom ſo; likewiſe in hollows, or concaves of the earth, or wells there will be a great noiſe, as if you were in a great ſtorm, and at night the ſtars looking very big with burrs about them, and the north-weſt ſky very black and foul, the ſea ſwelling ſtronger than at other times, as uſually it doth in great ſtorms, and ſometimes for an hour or two that day, the wind blows very hard weſterly, out of its uſual courſe: On the full of the moon you have the ſame ſigns, with a great burr about the moon, and many times about the ſun; the like ſigns muſt be taken notice of on the quarter days of the moon, in the months of *July*, *Auguſt*, and *September*, for the hurricanes come in thoſe months; the ſooneſt the Captain heard of, was the 25th of *July*, and the lateſt was the 8th of *September*; but the uſual month they come in is *Auguſt*.

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The benefit the Captain had of foretelling theſe hurricanes, was, that whereas heretofore they were ſo dreadful that all ſhips were afraid to go to ſea, and rather chuſe to ſtay in the roads at anchor, than to run the hazard of the mercileſs ſea, altho' never a ſhip eſcaped at anchor, but was caſt a ſhore many times by the violence of the ſtorm, ſome veſſels having been caſt ſo far on the ſhore, that when the ſtorm was over, they have been from 20 to 30 yards, dry from the waſh of the ſhore, and the veſſels ſet whole, by which means the lives of thoſe that were in them were ſaved; but the Captain finding, that if a man keeps his ſhip ſailable, with good ſtore of ballaſt, his ports well barred and cauked, his top-maſts down, and his tops too, if he have time, his yards laced a-port, keeping the doors and windows of his ſhip faſt, ſhe will lie as well as in other ſtorms; and they may, having their ſhips in readineſs, ſtay in the road till the ſtorm begins, which is always firſt at north, ſo to the north-weſt, till it comes round to the ſouth-eaſt, and then its fury is over; ſo that with the north wind they may run away to the ſouth, to get themſelves ſea-room for the drift of the ſouth-weſt wind, where it blows very fiercely; by theſe means the Captain, with God's bleſſing, preſerved himſelf in two hurricanes at ſea, and in three on ſhore; in thoſe at ſea he did not loſe a ſail, yard, or maſt, tho' they were great hurricanes.

The reaſons and cauſes of theſe violent ſtorms, according to the Captain's judgment may be theſe; 1. It is known to all men of experience, that to the ſouthward of the *Tropic* there is conſtantly a trade-wind, or eaſterly wind, which goes about from the north to the ſouth-eaſt all the year over, except where there are reverſions of breezes, and inlets near the land; ſo that when this hurricane, or rather whirl-wind, comes in oppoſition to the conſtant trade-wind, then it pours down with that force and violence, that it exceeds all ſtorms of wind in the world; for it takes trees away by the roots, and thoſe that are extraordinary ſtrong rooted, it twiſts off in the middle: In a hurricane at *Nevis*, the Captain ſaw a high mountain that was all green with trees, left in moſt places bare, and the wood lying in ſuch a condition, with half trees, or ſtumps, or quarters, that one would think it almoſt incredible. 2. It is remarked by all men, that have been in thoſe parts where the ſun comes to the *Zenith*, that at his approach towards it, there is always fair weather; but at his return to the ſouthwards, it generally occaſions off the north parts of the *Equinoctial*

much rain and ſtorms, as tornado's and the like, which makes the wind in the tornado's come on ſeveral points; but before it comes, it calms the conſtant eaſterly winds, and when they are paſt, the eaſterly wind gathers force again, and then the weather clears up fair. 3. The wind being generally betwixt the *Tropics* eaſterly, unleſs at ſuch times as before declared, meeting with the oppoſition of theſe hurricanes, which come in a contrary courſe to that trade-wind, cauſes this violent whirlwind, upon the ſun's leaving the *Zenith* of *Barbadoes* and the adjacent iſlands; by which the eaſterly wind doth loſe much of its ſtrength, and then the weſt wind, which is kept back by the power of the ſun, pours down with the greater violence and force upon thoſe parts where it gets vent; and it is uſual in ſailing from *Barbadoes*, or the iſlands thereabouts, to the north for a weſterly wind, when they begin to loſe the eaſterly wind, to have it calm, as is uſual before hurricanes; and then the wind ſpringing up, till it comes to be well ſettled, cauſes the weather to be various; but after the ſettled weſterly wind comes freſh, they have been conſtantly without thoſe ſhufflings from point to point.

Here it is to be obſerved, that all hurricanes begin from the north to the weſtward, and on thoſe points that the eaſterly wind blows moſt violently, the hurricane blows moſt fiercely againſt it, for from the N. N. E. to the E. S. E. the eaſterly wind blows freſheſt; ſo doth the W. N. W. to the S. S. W. in the hurricane blow moſt violent; and when it comes back to the S. E. which is the common courſe of the trade-wind, then its violence ceaſes, and ſo breaks up. And thus the Captain took the cauſe of hurricanes to be the ſun's leaving the *Zenith* of thoſe parts towards the ſouth, and ſecondly, the reverſe or rebounding back of the wind, which is occaſioned by the calming of the trade-wind, to proceed from the ſame cauſe. But it will be objected, why ſhould not this ſtorm be all over thoſe parts of the *Weſt-Indies*, as well as *Barbadoes* and the *Leeward* iſlands? To which the Captain anſwers, that it had in about 25 years of his experience, taken its courſe from *Bermudas*, or the *Summer* iſlands to the *Caribbee* iſlands, but ſeldom or never doth it reach ſo far, as from the latitude of 16 to 32 degrees, which are the latitudes of the one and the other place; but it has been obſerved, that when hurricanes have been in *Martinico*, which is within two degrees of latitude and two degrees of longitude, according to the miles of that circle, yet no hurricane hath been in *Barbadoes*. Again, it has been obſerved, that hurricanes have done the like to the northwards; for when the hurri-

hurricane hath been in *Antegoa* and St. *Chriſtopher*'s, thoſe ſhips that were in the latitude of 20 degrees, had no hurricane, but conſtant weſterly winds reaſonably fair, and then there were no hurricanes in *Bermudas*, and when the hurricanes were at *Bermudas*, the *Leeward* or *Caribbee Iſlands* had none; nor had thoſe iſlands the hurricane when *Barbadoes* had it. It may be further objected, why the hurricane was never known to go farther to the weſtward than *Porto Rico*, which lies in or near the latitude of thoſe iſlands of St. *Chriſtopher*'s? To this he anſwers, that from *Porto Rico* downwards, both that as well as *Hiſpaniola* and other adjacent iſlands are of vaſt greatneſs and have very high lands, that of themſelves moſt commonly give reverſal or weſterly winds at night thro' the year; for there, for the reaſons aforeſaid, the eaſterly wind towards night doth calm, and thoſe lands afford a land-wind, which the other iſlands cannot do, by reaſon of the ſmallneſs of thoſe *Caribbee Iſlands*, but very near the ſhore, the trade-wind has its full force till this general whirl-wind comes for the reaſons aforeſaid. He imagines likewiſe to the ſouthwards of *Barbadoes*, where the *Tornado*'s come frequently, there are no hurricanes; nor was there any at *Barbadoes* when theſe *Tornado*'s commonly came there, which made ſome ſmall reverſal, tho' it was but for two or three hours; yet the eaſterly wind, giving ſome way by the ſun's declining from that *Zenith*, prevents this furious reverſe, where it hath no vent, till it is forced by the violence of the two winds.

Of the Polarity of Drills; *by Mr.* Ballard. Phil. Tranſ. N° 246. p. 417.

1. MR. *Ballard* cauſed ſix or ſeven drills to be made, and the bit or point of every one became a *North Pole* by hardening only, before they ever came to be worked either in iron or any other matter, ſo that he could not ſuppoſe that thoſe found in the ſhop had got their polarity ſo much from their after uſe, as from their firſt make. 2. That pieces of plain iron, in ſhape like drills, that is ſomething long and ſmall, do always change their *Pole* as they are inverted, the end downwards being ever the N. *Pole*, he found not always true; for tho' it hold generally in ſuch ſmall pieces, and always as far as he could yet find in pieces of any bulk, as large hammers, anvils, and iron bars of windows, yet he found that ſeveral ſmall pieces of ſteel, ſuch as the drills are made of, had fixed *Poles*, one end north, the other ſouth, in whatever poſtures he held them; ſome of theſe were very

very vigorous in this their polarity, others ſhewed plainly a tendency to one *Pole*, rather than the other, yet ſo faintly, that they applied contrary to their inclination, that is at the upper end, if they affected to draw the ſouth, or at the lower end, if the north, by cauſing the needle to ſtand in *Æquilibrio*, eaſt and weſt, the particular inclination of one end ſeemed in ſome pieces quite to conquer, in others quite to hinder that more general polarity, they both acquire by being either upwards or downwards, yet this ſeems to be found only in ſmall ſtems of iron; they being upwards or downwards always prevailing in pieces of great bulk. 3. He took his knife which had been touched a quarter of a year or more and profering it to the needle, it drew the north *Pole*, which happened right for his purpoſe; he whetted it briſkly on a dry dirty threſhold, and being thin, it became very hot towards the point, the edge being whetted away to a wire, as they term it, he ſtruck the very top and back towards the top againſt the ground, as he had done the ſides, to deſtroy and rub off, if he could, all the former polarity, which was ſouthward; then offering it again to the needle, it drew the ſouth end and was quite changed; to confirm the thing, he touched the ſame knife again with the *North Pole* of his load-ſtone and it drew vigorouſly the north end of the needle; he whetted it again ſtrongly in the ſame manner, and it changed again; this he repeated five or ſix times, and it ſtill changed by whetting, eſpecially on the ſides towards the top of the knife, the very top and back, which could not be whet to ſo great a heat, retaining ſtill ſome affection for that *Pole* the load-ſtone had inclined them to; this he tried with a knife of a thicker blade, but could not whet it with his hand to that heat, ſo as to have the ſame effect, as upon his own knife, tho' he uſed ſuch force as at laſt to break it in two. 4. He ſuppoſes that bare drilling might be able to give a polarity to a drill, if it could be made indifferent, as well as filing does, and if the drill be uſed ſo briſkly as to be made as hot as the file makes the iron, and tho' a *South Pole* given by the magnet cannot be taken off by the heat of a briſk motion, as that of drilling, which yet by the experiment of his knife ſeems to be contradicted; yet perhaps the heat may be great enough to produce a polarity in an indifferent piece of iron, as may be done in little indifferent drill-like pieces of ſteel, by filing.

A Mi-

A Mineral Spring *near* Tournay; *by Mr.* Geoffry. Phil. Tranſ. N° 347. p. 430.

THERE has been found a mineral water, called St. *Amand*'s water, which has been very much uſed in all ſorts of ſickneſs, rather for its novelty, than for its great and extraordinary properties. The fountain is ſituated in a ſhallow and marſhy ground, the baſon of the ſpring is 450 feet ſquare, there is in the bottom of that baſon mud of 20 feet deep, beyond that they find ſand which is ſometimes very moveable and at ſome other times is very firm; very often this fountain caſts up a great quantity of ſand, and once in a little time it caſt up more than 16 cart-loads, by which all the baſon was bordered; there is to be found in it three ſorts of earth, the firſt and ſuperficial is black and burns like turf, with the ſame ſmell, the ſecond is white, and the third is of the ſame colour with the ſlate; theſe two laſt ſorts of earth give by *Lixivium* a ſalt like *Sal Gemmæ:* This water in its ſpring is clear and lukewarm, and appears much hotter at night and in the morning, than the reſt of the day; its ſmell and taſte is like that of ſtanding water, if it is expoſed to the air it ſoon loſes its ſmell and taſte; by the facility of loſing its taſte and ſmell, one may judge that it has a ſulphur very volatile; and by reaſon of that great volatility and ſubtility it is almoſt impoſſible to make any experiment upon it: This mineral water has the ſame weight as the *Seine* river-water; it did not change the colour of ſyrup of violets, the tincture of *Turnſol*, lime water, nor the oil of tartar; the volatile ſpirit of *Sal Armoniac* and hart's-horn have whited the water, and made in it a light *Coagulum*; this water mixed with the diſſolution of *Sal Armoniac* has not given it any ſmell; nor has it altered the infuſion of galls, the ſolution of vitriol being mingled with it has troubled it a little and given it a greeniſh colour, and at length a yellow powder was precipitated; acid ſpirits have not fermented at firſt with that water, but afterwards it has made ſome ſmall bubbles which ſtuck to the ſides of the glaſſes where the liquor was contained: Mr. *Geoffry* diſtilled five pints of that water, which when diſtilled had no taſte nor ſmell, nor did it change the tincture of *Turnſol* nor lime-water; from theſe five pints, being 160 ounces, there remained 70 grains of reſidue, which by *Lixivium* gave 55 grains of grey earth, and 15 grains of white ſalt, almoſt like *Sal Gemmæ*; the reſidue of the evaporated water put upon burning coals has not caſt any ſmoak, nor made any detonation; the ſpirit of nitre poured upon it has very much fermented;

mented it; the ſpirit of wine did not extract any tincture from that reſidue: One may conclude by all theſe experiments that this water has not any acidity, that it does not participate of vitriol nor of allum, and there is in it but a little quantity of the white earth, and leſs of ſalt which is very like ſea-ſalt; the parts that ſhew themſelves in the mixture of the lime-water, *&c.* are the earth and ſalt of fixed or volatile *Alcalis*; theſe are the ſame parts which begin that ſlight fermentation by the mixture of acid ſpirits; but that fermentation is imperfect becauſe of the little quantity of earth, that is drowned in ſo great a quantity of liquor; indeed when the water is evaporated, the acid ſpirits ferment very much with the reſidue: It appears by the ſmell of that water that it contains a ſulphur very ſubtile, which diſſipates itſelf very eaſily and is not ſenſible in the experiments; the effects which are aſcribed to that mineral water, as of relieving the palſy, *&c.* is nevertheleſs owing to this ſulphur; as alſo its being uſed with ſucceſs in other ſorts of nervous diſtempers, in ſhortneſs of breath and all diſorders in the lungs, and in remedying many other infirmities that are cauſed by ſharp ferments, which this water ſweetens; and as to its other properties, as purging, tempering the hot intrails, *&c.* it may have the ſame effects with common water when drunk plentifully: One may drink many glaſſes of this water, beginning with 4, 6 or 8 every morning, and augmenting to 12, 18, 20 or more, according as the ſtomach is well able to bear it; this water paſſes readily by urine, and many perſons are purged by it; ſometimes one may mix with it ſome diuretic ſalt to make it paſs the more freely and remove the more obſtructions; at other times one may put *Manna* or ſuch like for making it the more purgative; and one may waſh alſo in the mud of that fountain according as he has occaſion.

Some Experiments and Obſervations concerning Sounds; *by Mr.* Walker. Phil. Tranſ. N° 247. p. 433.

MR. *Walker* provided a *pendulum* of ſmall virginal wire with a piſtol-bullet to the end of it being 9 $\frac{4}{10}$ inches long to the middle of the bullet, which had two vibrations in a ſecond of time, he took his *pendulum* and ſtanding over againſt a high wall he clapt two pieces of ſmall boards together and obſerved how long it was ere the eccho returned, and he removed his ſtation 'till he found the place to which the eccho returned in about half a ſecond; but that he might diſtinguiſh the time more nicely, he clapt at every ſecond of time, 10 or 15 times together; ſo that by this means he could the better diſcover whether the

the distances between the claps and the ecchoes and the following claps were equal; and tho' it be very difficult to be exact herein, yet he could come within some few yards of the place he sought for, thus; he observed two places in which he could but just discover where he was too near, and where he was too far off, and from the midway betwixt them he measured to the wall, which measure doubled was the space that the sound moved in half a second.

Here follow the number of *English* feet which a sound moved in one second of time at several trials.

Trials	Feet	Trials	Feet	Trials	Feet
1	1256	5	1292	9	1278
2	1507	6	1378	10	1290
3	1526	7	1292	11	1200
4	1150	8	1185		

Mersennus mentions an experiment wherein he found the motion of a sound to be 1474 feet in a second of time; the academy *del Cimento* caused six harquebusses and six chambers to be fired one after another at the distance of 5739 *English* feet, and from the flash to the arrival of each report was 5 seconds, and repeating the experiment at the midway, the motion was exactly in half the time; and Mr. *Boyle* observed that the motion of sound passes above 400 yards in a second; when the first trial was made there was some wind stirring, tho' not much; the 2d, 3d and 6th were made in a calm morning; in the 8th the eccho was returned from a wall at 395 yards distance in two seconds; and in the 9th and 10th at 213 and 215 yards distance in one second; the 4th was made at one end of St. *John*'s cloister in *Oxford* which is 104 feet 7 inches long, where the sound was reflected 11 times in two seconds, and the 5th on the north side of *New College* cloister, which is 160 feet 8 inches long, where there were 7¼ ecchoes in two seconds; by some of the experiments he made, he was inclined to think that the sound moved quicker when it was calm, than in a wind, even when the sound moved half way with the wind, and that it moves swifter at first than afterwards; there is seldom any eccho where there is not some wall, wood, bank or such like directly opposite, that may reflect the sound to the person that makes it; but in St. *John*'s grove if you stand near the gate leading from the *College* to the grove, and clap, the eccho will return to you from the ball-court, tho' a line drawn from you to the ball-court be not perpendicular to the wall there,

but as oblique as the line Fig. 5. Plate IX. A B is to the line B C, where A repreſents the gate, B C the *Ball-court* wall, and B D another wall; or if you ſtand at E the corner of the grove next to *Trinity*, and clap, the eccho will return to you from the *Ball-Court*; in the ſame grove he ſtood about 20 yards from the ſame gate, and the gate being ſhut he clapt and at other times ſtamped, and the eccho returned from the gate as loud, if not louder than the clap or ſtamp; an eccho reflected from a gate or door has uſually a baſer and duller ſound than that which is returned from a wall, this being much briſker: As he has been walking towards a wall he clapped his hands together ſeveral times, and could diſtinguiſh the eccho from the clap, till he came within 7 or 8 yards of the wall; in the cloiſters where the eccho was repeated ſeveral times, the firſt repetition ſeemed to be ſlower than the ſecond or third, but of all the repetitions beſides the firſt, the ſubſequent ſeemed ſlower than the precedent; he obſerved the toſſing of a ſound forward and back again in very many places where there are parallel walls; and where the diſtance of the wall is leſs, there the ecchoes follow one another quicker; whereſoever a ſound was thus toſſed betwixt two walls, if he ſtood about the middle, he could hear the ſound twice as quick, that is twice as often repeated in one ſecond, as if he ſtood near one wall, the ſound being reflected to him from both ends, when he ſtood in the middle: In *Trinity Ball-court*, when he ſtood and clapt Fig. 6. at B, three or four yards from the end of the wall C, or at A which is oppoſite to B, the ſound was toſſed betwixt the oppoſite walls, but not half ſo long as when he ſtood exactly betwixt the walls; in places where there are parallel walls not above 6 or 8 yards aſunder, as in *Trinity Ball-court* and at the entrance into St. *John*'s *Grove*, &c. he heard the ecchoes of a clap following one another diſtinctly enough; but there the ecchoes of a muſical note which was longer than a clap, were ſo confuſed that they ſeemed one continued long ſound, which made him think that the eccho in ſome vaults is nothing elſe, but the ſound toſſed betwixt the ſide walls and betwixt the top and bottom; this alſo made him conjecture that the reaſon why ſtringed inſtruments give a greater and longer ſound to the ſtrings, than if the ſtrings were fixt to a ſingle board, may be this; becauſe the ſound is toſſed from ſide to ſide in the belly of the inſtrument.

An Account of a Stone *bred at the Root of the* Tongue; *by Mr.* Bonavert, Phil. Tranſ. N° 247. p. 440.

THomas Wood of *Wrotham* was ſo troubled with a quinſey that he could hardly ſwallow any liquid; Mr. *Bonavert* found the tumour tend to ſuppuration inwardly about the root of his tongue on the right ſide, but without any ſign of ſuppuration outwardly, tho' it appeared there almoſt as big as an egg; he ordered the patient maturating gargles, and the next day he broke it with his finger and brought out of his mouth near $\frac{1}{4}$ of a pint of matter, and with it at laſt a ſtone Fig. 7; he had likewiſe a *Ranula*, and before he had broke the tumour and ſpit out the corruption he could hardly ſpeak; Mr. *Bonavert* believed that this ſtone was of the ſame nature as thoſe generated in the kidneys and bladder: The weight of this ſtone in air was 7 grains, in water $3\frac{5}{8}$, and therefore its ſpecific weight compared with water is as 1931 to 1000.

A Piece of Saxon *Antiquity found in* Somerſetſhire; *by Dr.* W. Muſgrave. Phil. Tranſ. N° 247. p. 441.

THERE, Fig. 8. Plate IX. was a curious piece of antiquity lately found at *Askelney* in *Somerſetſhire* where king *Alfred* built, according to *Milton*, a fortreſs, but according to *William* of *Malmsbury*, a monaſtery, in memory, as ſome think of his deliverance, obſcure retreat and concealment in that place from the *Danes*; the work is ſo very fine that ſome have queſtioned its true age, but in all probability it did belong to that great king; the edge is thin as far as the letters, which are upon a plane riſing obliquely; all within the inner pyramidal line is on a plane equidiſtant from the reverſe; the repreſentation in that upper plane ſeems to be of ſome perſon in a chair; it is in enamel covered over with a chryſtal, which is ſecured in its place by the little leaves coming over its edges; in the reverſe are flowers engraved; the whole piece may weigh three guineas; except the chryſtal and enamel it is all of pure gold; which perhaps was an amulet of king *Alfred*'s.

An Account of the Catalogue *of* Manuſcripts, *printed at* Oxford. Phil. Tranſ. N° 247. p. 442.

THIS catalogue valued at 1 *l.* 2 *s.* conſiſts of two tomes, the firſt takes in the manuſcripts in the *Bodleian*, *Savilian* and *Aſhmolean* libraries, which belong to the univerſity in general, in part 1ſt, and the manuſcripts in moſt of our college-

libraries in part 2d, with those of the libraries of the *University of Cambridge* in part 3d: The second tome gives in part 1st, catalogues of the manuscripts in the libraries of many of the cathedral churches and of several of the nobility and gentry; and in part 2d are some catalogues of the manuscripts in some libraries in *Ireland*, with a peculiar index to each of these parts; at the beginning of the book is prefixed an epistle concerning the nature and use of it, which is followed by a preface that endeavours to excuse some faults which nice people find in some of the catalogues, and acquaints with the method taken in composing the indexes, with a list of all the catalogues comprehended in the whole; then comes the life of Sir *Thomas Bodley* the founder of the publick library at *Oxford*, with the history of it and an account of its chief benefactors; the first catalogue is that of those *Greek* manuscripts which once belonged to *Signior Francesco Baroccio* a *Venetian* gentleman, that were highly valued in *Italy* and brought over into *England*, which by the persuasions of archbishop *Laud* the old earl of *Pembroke* bought and presented to the *University*; these books have been oftentimes celebrated by many authors of note, to whom they have been highly serviceable, containing a great number of excellent tracts of the *Greek* fathers never yet published, besides divers ancient historians and geographers; and particularly a good deal of *Chrysostom*, and indeed they have been constantly esteemed as the most noble parcel of *Greek* books, that were ever yet reposed in any *English* library: The manuscripts of Sir *Thomas Roe*, which he brought over with him from the east, and those given by *Oliver Cromwell* have as good a character, considering their numbers, this last, being accounted as the remaining part of the *Baroccian* library, the earl thought fit to detain and were afterwards given by *Cromwell*; after these is a catalogue of the manuscripts of archbishop *Laud* 1300 in number, which he gave the *University* at several times, besides what he gave to St. *John*'s college in *Oxon*; the manuscripts are written in these languages, *viz.* *Hebrew*, *Syriac*, *Chaldee*, *Æthiopic*, *Armenian*, *Arabic*, as well *African* as *Asiatic*, *Persian*, *Turkish*, *Chinese*, *Japonese*, *Malagan*, *Malabaric*, *Russian*, *Greek*, as well the vulgar, as *Scholastic*, *Latin*, *Italian*, *German*, *Bohemian*, *Irish*, *Anglo-Saxon*, *English*, and one book of the hieroglyphics of *Mexico*, as there are several others in other parts of the library; what noble copies do we find here of the sacred books, fathers, historians, poets, orators, philosophers, physicians, mathematicians, *&c.* Besides the manuscripts in the languages abovementioned, given by

by archbiſhop *Laud*, there are books in the library written in the *Samaritan*, *Mendæan*, *Coptic* or *Egyptian*, *Siameſe*, *Peguan*, *Indoſtan*, *Sanſcreet*, *Tylingan*, *Ceylonian*, *Tartarian*, *Spaniſh*, *Portugueze*, *Britiſh*, *Francic*, *Friſian*, *Gothic*, and *Iſlandic*; after theſe follow the manuſcripts of Sir *Kenelm Digby*, chiefly mathematical, tho' there be many other valuable books among them on other ſubjects; then comes a great number of other manuſcripts, given by many particular perſons, and now inſcribed to Sir *Tho. Bodley*; as alſo the manuſcripts of Mr. *John Selden* in the *Greek* and oriental languages, with ſome others of his ancient books; next to theſe come in order the books which are ſaid to be in *Hyperoo Bodleiano*, the chief parcels whereof are, 1. Thoſe given by Dr. *Huntington*. 2. Thoſe bought by the univerſity of Mr. *Greaves*. 3. The collections of Dr. *Rich. James*, bought by the univerſity, which are more particularly accounted for afterwards. 4. Thoſe given by the Lord *Fairfax*, amongſt which are the collections of Mr. *Dodſworth*. 5. Thoſe bought by the univerſity out of the Lord *Hatton*'s library, amongſt all which are many books of very great value; Mr. *Dodſworth*'s collections make 160 volumes, written with his own hand, and they contain a vaſt treaſure of antiquities of all ſorts relating to our *Engliſh* hiſtory; next to theſe, in the catalogue, follows an exact account of the collections of Mr. *John Leland*, written all with his own hand, in which his deſign was to ſet forth *England* in its true light; the next parcel of books are thoſe of the late learned Mr. *Francis Junius*, which he bequeathed to the univerſity, all of them relating to the northern languages; ſome of theſe are the old manuſcripts themſelves, others are copies of the moſt conſiderable *Saxon* manuſcripts in the *Cotton* library, *&c.* accurately tranſcribed by himſelf, or elſe his own works, almoſt ready for the preſs; or laſtly, ſome curious printed books with his written notes and amendments; then follow the papers of *Iſaac Caſaubon*, and the *Adverſaria* of Dr. *Langbain*, both in their own hands, and afterwards a catalogue of part of the manuſcripts bequeathed to the univerſity by Dr. *Mareſchal*; next comes the titles of the oriental manuſcripts of the learned Dr. *Pocock*, which the univerſity bought of his widow; and a catalogue of the manuſcripts of Dr. *Huntington*, the univerſity bought of him ſince his return from the eaſt; as alſo thoſe books bought by Dr. *Hyde*, which three parcels containing in them many books of an extraordinary price and value, joined to what was in the library before, and has come in ſince, furniſh any ſcholar with ſufficient helps to purſue his ſtudies in moſt of the languages: After theſe there is

an

an account of the manuſcripts Dr. *Barlow* bequeathed to the library, which is followed by the particulars of the manuſcripts left by Sir *Will. Dugdale* to the *Aſhmolean Muſæum*, moſtly written with his own hand; theſe are followed with a catalogue of the manuſcripts given by Sir *Henry Savil*, an account of ſome mathematical inſtruments belonging to the geometry ſchool, and a catalogue of the printed books there, being all mathematical; then comes a catalogue of the manuſcripts in the *Aſhmolæan* library, ranged under the following heads, as *Grammatici*, *Rhetorici*, *Muſici*, *Geometræ*, *Aſtrologici*, *Poemata*, *de re antiquaria*, *de re heraldica*, *Hiſtorici*, *Vitæ*, *Hiſtoriæ naturales*, *Chimici*, *Medici*, *Anatomici*, *Chirurgici*, *Juridici*, *Politici*, *Orationes*, *Geographici*, *Theologici*, *Magici*, *Prophetici*, *Fatidici*, *Miſcellanei*, *Mechanici* & *Epiſtolæ*; with an appendix, and an account of the manuſcripts left to the univerſity by the famous antiquary Mr. *Anthony à Wood*, which are alſo laid up in the *Aſhmolæan Muſæum*; laſtly comes the titles of thoſe manuſcripts bought of Mr. *à Wood*, and of thoſe left to the publick library by Dr. *Fell*, and ſome others: Theſe manuſcripts being between 8 and 9000 in number, make up the firſt part of the firſt tome, which is ſhut up with every author's name or tract, &c. in the foregoing catalogues; ſince this catalogue was printed, the univerſity bought all the papers, manuſcripts, and books collated with manuſcripts, &c. which were in the library of the learned Dr. *Edw. Bernard*, and ſome other manuſcripts have come in by the generoſity of late benefactors; the ſecond part of the firſt tome conſiſts of the manuſcripts in moſt of the libraries of the *Oxford* colleges in this order:

1	*Univerſity*-College, in which are Manuſcripts	165
2	*Baliol*-College	319
3	*Merton*-College	348
4	*Exeter*-College	52
5	*Oriel*-College	72
6	*Queen*'s-College	40
7	*New*-College	323
8	*Lincoln*-College	113
9	*All Souls*-College	50
10	*Braſen-Noſe*-College	16
11	*Corpus Chriſti*-College	271
12	St. *John*'s-College	199
13	*Trinity*-College	82
14	*Jeſus*-College	105

Mag-

15	*Magdalen*-College	239
	Omitted in *Merton*-College	1
	Omitted in *Corpus Chriſti*-College	7
	Given to *Queen*'s-College by Biſhop *Barlow*	106
16	*Magdalen*-Hall	12
17	*Wadham*-College	14
	Omitted in *Univerſity*-College	14
	Omitted in *All Souls*-College	16
		2564
	Given lately to *Lincoln*-College, by Sir *G. Wheeler*	76
	In all	2640

And theſe, except the appendix, have their own index, like the firſt part.

In the third part of the firſt tome, there is an account of the *Cambridge* manuſcripts, as

1	*Emanuel*-College, in Number	137
2	*Trinity*-College	563
3	*Sidney Suſſex*-College	76
4	*Gonvile* and *Caius*-College	580
5	*Bennets*, or *Corpus Chriſti*-College	395
6	*Peter-Houſe*-College	268
7	*Pembroke*-Hall	231
8	*Jeſus*-College	7
9	*King*'s-College	7
10	*Trinity*-Hall	7
11	The Publick Library	322
	In all	2293

Theſe catalogues, with their index, make up the third and laſt part of the 1ſt tome: The ſecond tome comprehends the libraries of many of our cathedral churches, noblemen, gentlemen, &c. the cathedral churches are thoſe of *York*, *Durham*, *Carliſle*, *Worceſter*, *Salisbury*, *Winchester*, *Litchfield*, *Hereford*, *Exeter*, *Wells*, and *Canterbury*; other libraries belonging to publick places here deſcribed, are thoſe of *Weſtminſter-College*, *Winchester-College*, *Coventry-School*, *Briſtol*, *Gray's Inn*, *Eaton-College*, *Greſham-College*, *Shrewsbury*, *Lincoln's-Inn*, *Sion-College*,

College, *Manchester* library, with directions to the manuscripts in the *Herald's-Office*, and to the records in the *Tower*: The manuscripts of the nobility are those of the Earl of *Carlisle*, the Earl of *Denbigh*, the Lord Viscount *Longuevile*, the Earl of *Peterborough*, the Earl of *Derby*, the Lord Bishop of *Norwich*, and the Earl of *Kent*; the largest catalogues of the gentry are those of Sir *William Glynne*, Dr. *Plot*, Sir *Thomas Wagstaffe*, Mr. *Leneve*, Dr. *Francis Bernard*, Mr. *Evelyn*, Mr. *Seller*, Sir *John Hoby*, Dr. *Johnston*, Mr. *Bromley*, Mr. *Onsley*, Mr. *Cherewynd*, Dr. *Tyson*, Dr. *Browne*, Sir *Henry St. George*, Dr. *Gale*, Mr. *Theyer*, Mr. *Pepys*, Mr. *Worsley*, Sir *Edw. Norwich*, Sir *Henry Langley*, Mr. *Jones*, Dr. *Todd*, Dr. *Edw. Bernard*, which last are all in the *Bodleian* library, Mr. *Thoresby*, Mr. *Burscough*, Mr. *Brotherton*, Dr. *Sloane*, Mr. *Cousin*, Sir *Geo. Wheeler* which he gave *Lincoln-College*, Mr. *Farmer*, and Sir *Simonds d'Ewes*; besides which, and others of less note, here is exhibited a catalogue of the manuscripts in his majesty's library at St. *James*'s, and one foreign catalogue, which is that of *Isaac Vossius*, whose manuscripts are at *Leyden* in *Holland*; this part likewise has its index: The second part of the second tome gives the catalogues of *Ireland*, viz. of the Earl of *Clarendon*, the books being *Irish*, and bought from *Ireland*; the next is that of the college of *Dublin*, then that of the Lord Archbishop of *Dublin*, with the titles of those oriental manuscripts which he bought out of the library of *Jacobus Golius*, and lastly of Dr. *Madden*; which last part has its particular index; as manuscripts are usually valued either for their antiquity, the language they are written in, their beauty, and for their variety, so on all these accounts our *English* libraries, and consequently these catalogues are of very considerable value.

The Tartarian Lamb; *by Dr.* Hans Sloane. Phil. Tranf. N° 247. p. 461.

FIG. 9. Plate IX. represents what is commonly, but falsely called in *India* the *Tartarian* lamb; this was more than a foot long, as big as one's wrist, having several protuberances, and towards the end had some foot-stalks about three or four inches long, exactly like the foot-stalks of fern both without and within; the most part of the outside was covered with a down of a dark yellowish snuff colour, shining like silk, some of it a quarter of an inch long, which is commonly used in spitting of blood, about six grains of it being taken to a dose, and three doses supposed to cure such a flux of blood; in *Jamaica* are many scandent ferns, which

which grow to the bigneſs of trees, with ſuch a kind of down upon them, and ſome of our capillaries have ſomething like it; it ſeems to be ſhaped by nature to imitate a lamb, the roots or climbing part being made to reſemble the body, and the extant foot-ſtalks the legs: Dr. *Merret* takes notice of this down by the name of *Poco ſempie*, a golden moſs, and he calls it a cordial; Dr. *Sloane* was aſſured by Dr. *Brown*, who had made very good obſervations in the *Eaſt-Indies*, that this down, or hair, is uſed by them for the ſtopping of blood in freſh wounds, as cobwebs are with us, and that they have it in ſo great eſteem that few houſes are without it; Dr. *Sloane* has known it much uſed in ſpitting of blood, it being pretended that ſome of the ſmall down may, by being ſwallowed, eaſily ſlip into the wind-pipe, and ſo ſtop the bleeding; but on trials he had ſeen made of it, tho' he believes it innocent, yet he was ſure it was not infallible.

A Deſcription of Snake-root; *by Mr.* John Banniſter. Phil. Tranſ. N° 297. p. 467.

THE *Piſtolochia*, *Serpentaria Virginia*, or ſnake-root, hath a buſhy root, conſiſting of a number of ſmall ſtrings of a yellowiſh colour, and of a hot aromatic ſcent and taſte; thence grow one or two ſmooth, at leaſt very ſmall hairy ſtalks, round and moſt commonly upright, not ſquare nor trailing; the leaves grow alternately on this ſide and that, one at a joint or knee, they are thin, long and pointed, coming in like a heart at the foot-ſtalk, a little hairy above, and rough with many protuberant veins underneath, and in handling they ſtick a little to the fingers; near the ground grow one or two hollow flowers, each upon its proper foot-ſtalk, different in form from the *Piſtolochia Cretica*, or any other yet known, all whoſe flowers (if author's figures, or the plants themſelves dried, rightly informed him) reſemble a cow's horn, the top growing to the rudiments of the ſeed-veſſel, and the open end cut ſlanting like a drenching horn, whereas this terminates with a heel, which ſupports a broad, round, galericulated lip, the centre of which opens into the hollow of the flower; the lip is of a light ruſſet colour; the ſeed-veſſel is hexagonal, ſhaped like a pear, when full grown near half an inch in diameter, it is not an ever-green, but after the ſeeds are ripe, the leaves and ſtalks begin to wither and decay; it flowers in *May*, and its ſeeds are ripe in *Auguſt*.

An Account of Amber; *by M.* Phil. Jac. Hartman. Phil. Tranſ. N° 248. p. 5. *Tranſlated from the* Latin.

THE known virtues of amber in ancient times have made the *Greek* writers celebrate it many ages before Chriſt; as *Plato* and *Ariſtotle* amongſt the philoſophers, *Herodotus* and *Cteſias* amongſt the hiſtorians, and *Æſchylus* amongſt the poets: After it came to be admired by the *Romans*, they rendered it a famous gem, eſpecially when the luxury of *Nero*'s reign had taught them to abuſe it; a long time after that, preſents of amber were demanded in *Italy* by *Theodoricus*, king of the *Goths*: In how great ſoever an eſteem amber was of old, yet the countries that produced it, were unknown; from whence ariſes ſo great a diverſity of ſentiments about the place where this treaſure was to be found, ſome making *Afric* its native ſoil, others *Aſia*, and others again *Europe*; in *Afric*, the gardens of the *Heſperides*, *Egypt*, *Æthiopia*, and *Numidia*; in *Aſia*, *India*, and *Arabia* were eſpecially reckoned amber countries; in *Europe*, the moſt famous country for it was *Italy*, and in it the *Eridanus* and the *Adriatic* ſea; but more authentic hiſtory, after the *Romans* had ſpread their victorious arms all over *Germany*, makes its native ſoil to be chiefly the iſlands of the *German* ocean and *Baltic* ſea, not altogether excluding *Britain* and *Spain* from a ſhare in its production: Both the common report and written accounts of amber being the produce of the eaſtern countries, are either altogether uncertain or falſe: Nor is it produced in all the abovementioned provinces of *Europe*, yet it appears that amber has been dug up in *Poland*, *Sileſia*, and *Bohemia*, altho' the annals of thoſe countries rarely mention it; there is more frequent and clear an account given of the *German* amber; for the moſt approved authors affirm, that it has been gathered on the ſhore of the *Belgic* iſlands, in *Holſatia*, *Jutland*, and on the banks of the rivers, as alſo that it has been dug out of the bowels of the earth in *Saxony*, *Miſnia*, *Suabia*, &c. but there is a greater quantity of it in thoſe places that border on the *Baltic*; it is often gathered in *Swedland*, being either thrown out upon the banks of the lake *Meler*, or dug up there; amber is dug up in conſiderable quantities near *Copenhagen*, and out of the midland hills of *Zeland*; and in digging a ſmall hill, there were found to the quantity of 50 pound weight; according to *Borrichius*, in the iſlands bordering upon *Jutland* and *Holſatia* a great deal of it is found upon the ſhore; but in much greater plenty upon the coaſts of *Samogitia*, *Courland*, and *Livonia*, ſo that

that the country people find it commonly amongſt the ſea-weeds and ſand; the Duke of *Courland* fiſhes for it with nets; and when they plow the fields by the ſea ſide, it comes eaſily up: But no other maritime province gathers from the *Baltic* ſea, or digs out of the bowels of the earth ſuch quantities of amber as *Pruſſia* does, ſo that no where elſe with more juſtice can you place thoſe iſlands called *Electrides* by the ancients; whence the ambaſſadors of the *Æſtri*, who inhabited that country in the time of *Theodoricus* king of *Italy*, valued themſelves highly upon their country's yielding amber; and afterwards *Pruſſia* had that title given it by a great many authors, which was formerly miſapplied to *Italy*, viz. *Sola Genetrix Succinorum*, the mother of amber; and that it ſhould be famous for it, is owing not only to the great quantities taken out of the ſea, but alſo to what is dug out of the mountains near the ſhore, and in places diſtant from the ſea, which the country people unexpectedly find, when they either till, level hills, or make ditches.

Next to *Pruſſia*, *Pomerania* is noted for amber, eſpecially that tract of the coaſt that extends from *Oliva* and *Dantzic* to *Neria*; there is great plenty of it in the iſland *Rugen* in the *Baltic*, and it is gathered and dug up near *Heddenſee*; the inland parts of *Pomerania* do alſo abound in amber, for the country people do readily find it there alſo; and in this reſpect has the advantage by much both of *Courland* and *Samogitia*; but *Pruſſia* is moſt noted for amber, eſpecially that part called *Sambia* from *Neve Tiff* to *Vrantz Vrug*, which is ten miles; this country was formerly diſtinguiſhed by ſeven bays, or angles, called *Krecke*, *Nodums*, *Laſſnicken*, *Kuckſe* or *Kuyck*, *Palmenick*, *Nempe*, and *Thierskeim*; the whole coaſt is defended with high mountains, the ſea is full of ſhelves, at firſt entring it is three or four, and preſently after, thirty or forty fathoms deep; when you have gone on, it is ſhallower, and when you go farther ſtill, it is again deeper; ſo that you may ſuppoſe the coaſt to abound in quick-ſands, noted for ſhipwrecks; the cliffs of the bays or angles are ſteep and rugged, ſome of them are of an eaſier aſcent, and towards *Pillaw* they terminate in a plain; the ſoil is not very firm, and in ſome places dangerous, on account of ſubterraneous ſtreams of water, wherein both horſes and men have been ſwallowed up, as in a whirlpool; the greateſt part is covered with ſand, ſome few ſpots are cloathed with herbs, as eringo, burr, &c. with few copſes, or buſhes, here and there, which become hicker towards *Bruſter*; and theſe ſometimes ſink with a part of a mountain; there are no rocks, except at the foot of the hills,

the waters run down every way from the cliffs, and being collected below in channels, reſemble rivulets; this is the external appearance of the *Sambian* coaſt, whilſt its inſide abounds in minerals, and therein is found more than one ſpecies of vitriol; in ſome places it has white ſtreaks, with layers of black earth; in other places it looks like melted glaſs, with fibres of wood ſhining here and there; in others again it is ſprinkled, as it were, with a ſparkling powder; beſides vitriol, there is a barky kind of earth, of which there are whole hills, and a kind of wood that runs for a great way thro' the mountains on the ſhore; then there is a yellowiſh earth, that reſembles oker, a bluiſh clay extended along the coaſt at certain intervals; the moſt remarkable ſtones are the *Dactyli Idæi*, ſcattered amongſt the rocks and ſand, and they are alſo dug out of the mountains; the rocks, next the ſea, are very hard in one part, and in others friable; there is likewiſe found petrified wood, and ſtones covered over with ſea-weed, of a ſmall and veſicular leaf; beſides common ſtone, this coaſt ſometimes yields diamonds and jaſper ſtones; the neighbouring fields are very barren; the woods are thin, and without any pine-trees; there are great numbers of whales ſeen baſking and playing on ſhelves in the ſea: On this coaſt amber is found amidſt heaps of ſtones and ſand, but it is not generated in them, much leſs in the ſea-weeds, tho' it is thrown out upon the ſhore, and wrap'd up therein; and notwithſtanding it is every where found within the bowels of the mountains by the ſea-ſide, in layers of vitriol, yellow earth, ſand, and bluiſh clay, yet its firſt original is not owing to any of theſe; and amber is ſeldom in the parts of vitriol, yellow earth, and ſand, and what is found therein is very ſmall in quantity, and of little value; as to the veins of bluiſh clay, the caſe is not ſo certain, becauſe they are unacceſſible, tho' the country people affirm that they contain excellent amber, and in great quantities; and M. *Hartman* having broken a piece of the clay, found real amber therein, which was covered over with a thin rind, and of a deep yellow colour: The experience of many years confirms, that the wood which runs thro' the mountains yields amber plentifully; and the diggers obſerve and follow its courſe, and always with ſucceſs, as far as the tottering ſoil will ſuffer them to go; the barky earth contains little amber, and that leſs firm, and of a diſagreeable colour; this wood can by no means be claſſed among the wood of trees; for never were ſeen ſuch large trunks of trees, which lying along, extend their fibres ſeveral fathoms in length and breadth; nor is it like the wood of trees, having neither pith nor bark, nor that divarication, or knottineſs of branches,

branches, nor budding of leaves as is the caſe in trees; neither does it alter its fibres, but has them alike in every part; and tho' reſembling wood yet it does not grow round but flatter: Upon the *Sambian* coaſt are hillocks on all hands, eſpecially at *Kraxtepellen*, which appear at a diſtance like hillocks of earth, but upon a nearer approach like heaps of bark; the upper part, as being dried by the ſun, was a greyiſh cruſt, and upon removing this, the next was a large, ſmooth and ſhining cruſt, as black as pitch, which, if cut with a knife, preſents to the view a contexture of a great number of very ſoft barks; at the root of theſe hillocks the earth is moiſt, cohering together by a glutinous liquor, exactly taking the prints of the fingers when you touch it, but ſo as to make them black: M. *Hartman* is of opinion that the barky fat earth of theſe hillocks gives origination to the *Pruſſian* foſſile wood; nor does this wood differ from the bark, except in its drineſs and in ſome degree of ſolidity, by which being more compact it coheres the cloſer by the great extenſion of its fibres; the barky hillocks have their origin from this moiſt tenacious earth, which, when macerated by the ſalt water of the ſea, together with the other ſubterraneous ſalts and the ſuperfluous moiſture evaporated, is either dried up by the air or heat of the ſun; and when this fatty moiſture is exhaled, or retired inwards, the parts are ſeparated from each other; other parts that abound in this glewy ſubſtance, do mutually cohere, tho' in cruſts, and have the appearance of wood: That the bark and wood are of a bituminous nature appears both by the fatneſs of the earth and by the fire; for they readily take fire, and ſmell of ſulphur; when diſtilled they yield ſome oily particles, that ſmell like petroleum, only that the liquor has ſomething of a fat amber ſcent; next to *Bitumen*, the ſubterraneous ſalts forward the production of the bark and wood, for their drineſs and cruſtineſs are owing to theſe, and they cloſely adhere to them; vitriol, as is above mentioned, ſurrounds the bark and grows together with it; the effects of other ſalts upon it are not ſo evident, yet M. *Hartman* found in the interſtices of that barky ſubſtance in very dry wood, little ſparkling cryſtals and bright ſtreaks of ſalt, which had little or no reſemblance to vitriol, being either altogether inſipid or of a ſweetiſh taſte, and of ſome degree of aſtringency; pouring water upon them, the lee taſted of allum or rather of iron, but ſo as ſtill to retain ſome vitriolic taſte, which became more ſenſible as the lee was thick, with the ſweetiſh reliſh of allum or iron; he alſo extracted nitre from this wood, after ſeparating, by making a ſtrong lee, the particles of vitriol; poſſibly the ſmall cryſtals

cryſtals and ſtreaks of ſalt, that penetrate into the innermoſt fibres of the wood, are of a nitrous nature. In order to account for the generation of amber, we are to ſuppoſe that the ſoil in *Pruſſia* is of a bituminous nature; for the country people often find great lumps of condenſed bitumen, that lay concealed in the earth or clay; and M. *Hartman* himſelf ſaw a piece taken out of the clay not far from *Koningsberg* weighing ſeveral pounds, and he was credibly informed that little brooks of oil ſprang out of the earth, and there are bituminous turf dug up in ſeveral places; ſo that the ſubterraneous heat collects into drops, eſpecially from the barky or woody matrix, the exhalations of bitumen diſperſed thro' the bowels of the earth; and at the ſame time pervades the neighbouring ſalts, and, carrying their effluvia along with it, mixes them with the bituminous drops; the ſaline *Spicula*, wedged into the matrix, fix the bitumen and bring it to a conſiſtence, and if there are no new ſupplies of bituminous drops, the glebe or lump takes its form according to the ſize of its matrix within the wood; and theſe parts, thus aſſociated, produce amber; which is clearer, more tranſparent, better ſcented and firmer, according to the purity and proportion of the bituminous and ſaline exhalations; and this is the true production of amber.

Some doubt whether the production of that amber thrown up by the ſea is to be accounted for in the ſame manner; but ſeeing it is commonly known that the rocks in the ſea have been rent and torn to pieces by the violence of ſtorms, and by that means have yielded amber in greater and leſſer quantities, according to the more ſlight or more violent breaking aſunder of theſe rocks; the ſame manner of generation may be alſo aſſigned for this ſpecies of amber. M. *Hartman* knew amber taken out of the ſtomach of animals, which made ſome by miſtake ſay it was generated there, and he was informed by the people that live on the *Sambian* coaſt, that animals of all kinds, both terreſtrial and aquatic, greedily ſwallow down the amber glebes, which are often found in their bowels: Ravens and crows come down in ſuch numbers, that in the evening they are obliged to drive them away and ſeveral ſmall pieces are found in their excrements under the trees where they perch; he had ſeen ſeveral pieces that had been ſwallowed by aſſes, the largeſt of which was three fingers long and two broad; there was a curious amber ball taken out of the ventricle of a ſheep, which by lying there contracted a whitiſh cruſt, and after an amber-poliſher had ſhaved it off, it appeared to conſiſt of ſeveral glebes, which were reduced into this form by

by the heat of the animals body: The country people in *Prussia* do, with nets fastened to a long pole, either turn up the bottom of the sea, or oppose them to the current, and this is called fished or draught amber, and what is taken up out of the weeds, wood and sand, and thrown in upon the shore is called *picked amber*; and what is dug out of the earth is called *fossile amber*; and in this they use a fickle fixed to the end of a long pole; the digging for it is superficial, not reaching deep in the earth, and was first attempted in the time of *Frederic William the Great*.

Amber, when taken out of the matrix, as M. *Hartman* observed at the pits, is, tough and hard to the touch; and it sometimes happens to break in digging, but that is owing to the glebe, for some amber is harder than other some; and tho' authors affirm that they have seen the same piece of amber, partly soft and partly hard; yet M. *Hartman* could not discover either by its fragrant taste, or by the fire that it was amber, and all such as are conversant in those affairs affirm that they never knew any that was soft, whether *draught*, *fossile* or *picked amber*; and M. *Hartman* himself, having carefully examined heaps of rude amber, found none that was soft, which he would have discovered, were there any such, by the frequent experiments he made of its virtues; it is the common opinion that the chief difference betwixt the *fossile* and *draught amber* consists in its hardness, purity and crust, but they are mistaken who think so; for it happens, that such pieces as are found without their matrix contract some defect in their firmness or heat, and are covered with a pretty thick crust; but these accidents do not infer any difference in the native amber; for he was well assured that a good and indifferent sort was equally generated amidst the rocks in the sea and those on the shore, according to the different quantities and virtues of the generating bitumen and salts.

Nature is very curious in the formation of amber glebes, so as variously to represent pears, almonds, onions, pease, *&c.* the amber-polishers call them drops, when they are nearly globular; the several figures and representations on other pieces of amber are no less surprising; M. *Hartman* saw several whereon nature had formed different letters; in one there was a white line which by it's bending neatly formed the letter S, some had rude draughts of *Arabian* and *Hebrew* characters; besides that, a nice eye might distinguish on the variegated amber the outlines of shrubs, leaves, clouds, *&c.* he had one piece of amber whereon was represented the picture of an old man, with a child in his arms.

Pliny

Pliny and *Martial* mention ſeveral animals found buried in amber; M. *Hartman* reckoned above 30 ſpecies of inſects in pieces he had by him, as flies, ſpiders, gnats, ants, butterflies, bees, *millepedes*, moths, mites, cankerworms, beetles, *&c.* ſome authors mention more perfect animals incloſed in amber, as frogs, lizards and ſmall fiſhes, but the truth of this may be ſuſpected, ſince it is found that ſmall fiſhes may by art be included in amber: To diſtinguiſh that amber, in which nature has incloſed theſe animals from that in which art has included them; we may obſerve that in the former the inſect is not far from the ſurface, but in the other it is in the centre, for the amber-poliſhers could not ſo well conceal their art if they had put their animals in the ſuperficial parts, for the tranſparent plates of amber would diſcover the cheat; if the amber wherein the animals are incloſed be ſolid, clear, free of cracks and without a contexture of different cruſts, it is a ſure ſign that it is artificial; for generally the parts of amber glebes wherein animals are repoſited, as M. *Hartman* obſerved a thouſand times, either cohere like bark, or are interſected every way with fiſſures, in which ſome parts of the animal appear externally; the condition of the animals within the amber is different, ſome are covered with dirt, ſome are clear and ſome glittering with an amber brightneſs; you may alſo obſerve ſome to be lively, and others languiſhing, and ſome as if they were attempting to extricate themſelves from their priſon; in ſome amber whole ſwarms of inſects both of the ſame, and different kinds are obſerved.

Hence ariſes a queſtion much agitated amongſt the curious, how amber comes thus to have animals incloſed in it? A great many, puzzled with the difficulty, contend that amber is the juice of a tree, as if animals could be more eaſily entangled in the reſinous and gummy juices of trees; but experience does not ſupport this; for it has not hitherto been diſcovered that inſects are incloſed in great numbers, if in any at all, either in reſinous or gummy juices, for they are ſeen ſticking externally thereto and not included in ſo liquid a ſubſtance; others again have denied them to be real animals, and pretend that it is a mere deluſion; but any one may be ſatisfied to the contrary, by viewing a piece of broken or cut amber, for there ſtill remain evident traces of the inſects.

The better to underſtand how inſects are fatally buried in amber, we need only reflect that it is uſual for them upon a violent ſtorm or rigorous ſeaſons to ſeek for ſhelter in caverns, and there lie buried in ſleep; and when the bituminous exhalations, col-

collected by the ſubterraneous heat, diſtil into the matrix of amber, which afforded both a dormitory and place of retreat to theſe inſects, they are covered thereby, and when that bitumen becomes amber, they are plainly ſeen within it; what confirms this conjecture is, that moſt of theſe inſects, that are buried in amber, are of that kind, which chuſe caverns for their dormitories; the greateſt part appear languid, or ſlimy; ſuch as are lively make an effort to ſpread their wings, and diſentangle themſelves, but theſe are rarely to be found.

The moſt beautiful pieces of amber are ſuch as have buds of plants within them: M. *Hartman* had one piece in which the expanded leaves of the veſicular ſea-weed repreſented the extended wings of an eagle, with its body and feet; another piece contained a ſeed of the tile tree and a part of the trunk; another had an open pod with four ſeeds, out of which aroſe an *Apex* in the middle, the ſmall ſtalk being prominent and extending to the ſuperficies of the amber; another preſented to view moſs, that was arched like a balcony; another appeared like a little flower that was faded; in another there was a branch of wild roſemary with 3 leaves upon it; and thro' another rough piece was ſeen a large branch of the abovementioned veſicular ſea-weed: M. *Hartman* reckoned the amber in which herbs were included to be more beautiful than that in which animals are incloſed.

Minerals are likewiſe incloſed in amber; vitriol is ſoon diſcovered by its taſte; ſometimes *Pyrites*, and oftentimes iron is found therein; alſo gold and ſilver in the impure amber; drops of water are likewiſe obſerved in ſeveral parts thereof; which is either ſalt, brackiſh, or ſometimes inſipid: M. *Hartman* ſuppoſed that theſe plants or minerals had alſo dropped into the matrix, and were there ſurrounded with the bituminous liquor; and there is a particular method of accounting, how drops of water come to be in amber; and it is this, a warm bituminous exhalation encompaſſes the moiſt matrix, the water driven inwards, cannot be evaporated by the ſubterraneous heat and by reaſon of the circumambient bituminous liquor can find no paſſage out, but is detained there.

Amber is not to be reduced to the claſs of metals, as being neither fuſible nor ductile; and when brought into fuſion, it loſes much of its firmneſs, which is never the caſe as to metals; ſome have pretended to the art of melting amber, and of re-uniting its ſmall broken pieces without impairing its hardneſs; but M. *Hartman* found by ſeveral experiments that no ſuch thing was practicable, becauſe the ſalts, wherein the greateſt firmneſs of amber

conſiſts, evaporate in the ſolution, nor can they be retained without ſome additament, and even that impairs its ſolidity, but he thinks, that ſuch a ſkill is not to be diſpaired of, could a like gentle heat be applied as nature makes uſe of in animals; for a ball of amber found in the ventricle of a ſheep, conſiſted of ſeveral ſmall bits, which every where ſhewed the traces of their junctures, and this ſhews that nature does not apply a fire fit to melt, but ſuch a gentle heat as is proper to glue things together; much leſs is amber to be reduced to the claſs of earths, or ſalts, as being more compact than earth, fatter than ſalt, and moiſter than either; it comes nearer the nature of bitumens and ſulphurs, yet differs from theſe in hardneſs, there being no pure bitumen or ſulphur ſo firm as that is.

Amber for its hardneſs may be claſſed amongſt ſtones, and for its brightneſs amongſt gems, tho' ſome ſorts of it are brittle; yet amber poliſhers find the white ſort ſo hard as to blunt their edge-tools; pop-guns and mortars made of it receive no damage from the exploſion; amber is chiefly valued for its hardneſs and ſolidity; the chief virtue the ancients found in amber, and which diſtinguiſhed it from other gems was its attractive force, ſo that they called all thoſe bodies electrical that had the faculty of attracting; which power of attraction the moderns who have been more exact in their experiments have diſcovered in ſeveral other gems, ſtones, glaſs, reſinous and bituminous bodies, ſulphur, aſphaltus and lac; yet amber attracts more ſtrongly than other gems.

Amber has a peculiar fragrancy, which no other gem yields, no nor any of the aromatics; as thyme, myrrh, camphire or maſtic; there is ſomething of a reſemblance of ſmell in the reſinous glebes found in ant-hills, but when you rub or burn them the difference is directly perceived; the ſmell of the yellow or fiery ſort differs from that of the white; the effluvia of the former are fat, and therefore ſofter, but thoſe of the latter are ſalt and more acrid, and they differently affect the noſe; amber has alſo a peculiar taſte, which yet varies according to the proportion of the oily and ſaline particles; the white ſort is pungent upon the fibres of the tongue, but the yellow not ſo; amber differs from moſt other gems in the variety of its colours, and is never black, the opaque ſort is rarely found, the pellucid is the pureſt; and in fine you can ſcarcely name a gem that equals it in lightneſs.

Its chief virtue, and to which no other gem comes up, is in curing the diſtempers of animals; crude amber is of ſervice, applied either inwardly or outwardly; the *Indians* and *Chineſe* are ſo very

PLATE. X.

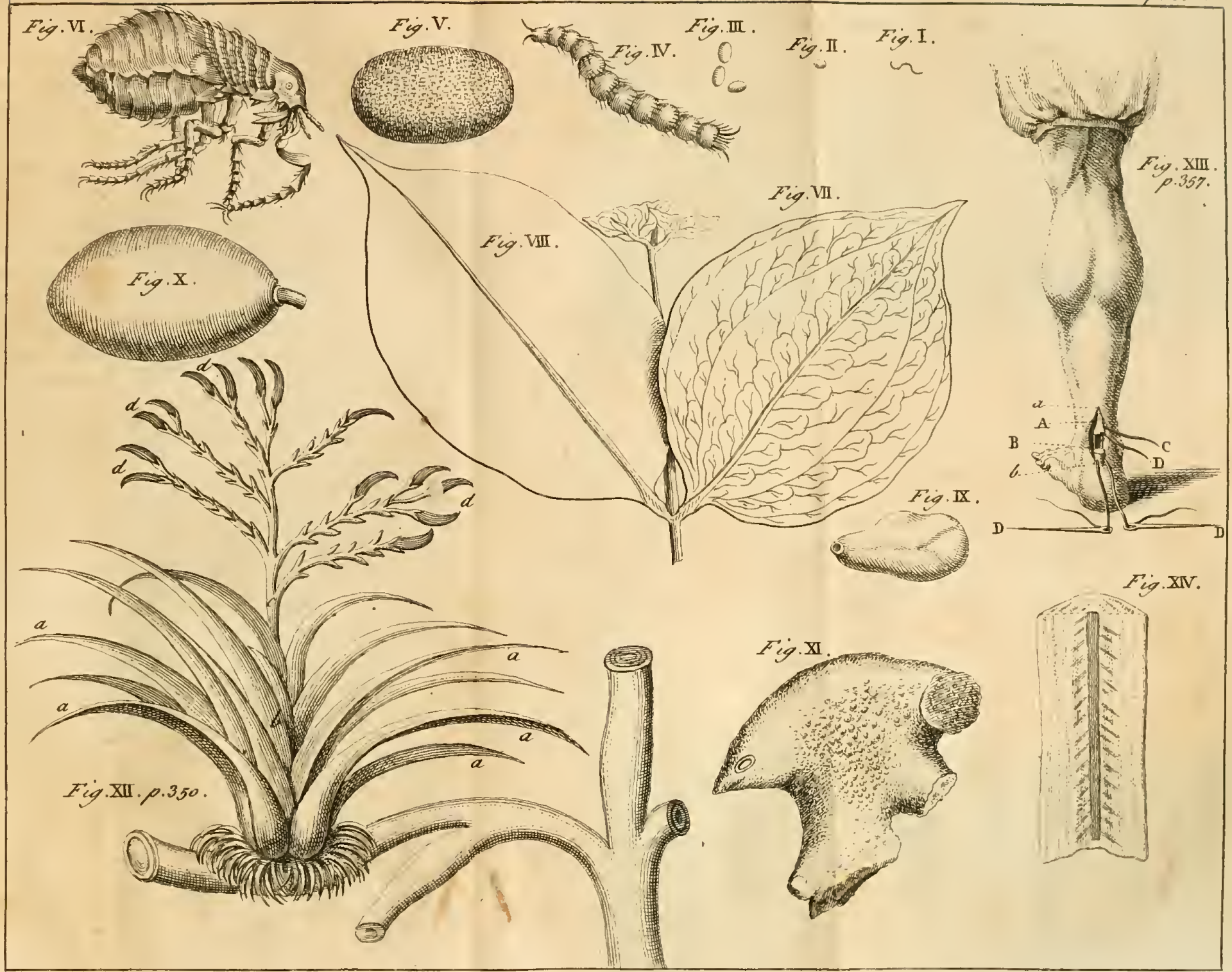
Fig. VI.
Fig. V.
Fig. IV.
Fig. III.
Fig. II.
Fig. I.
Fig. XIII. p. 357.
Fig. VII.
Fig. VIII.
Fig. X.
Fig. IX.
Fig. XIV.
Fig. XI.
Fig. XII. p. 350.
a
A
B
C
D
b
d

very fond of ſuffumigations thereof, as to run into exceſs; the common people imagine it of ſervice in catarrhs; and the amber poliſhers of *Konigsberg* gave out that it was owing to the alexipharmic exhalations thereof that they eſcaped the plague; however there is no ſuffumigation which preſerves from contagion more effectually than that made of amber, nor have groſs or peſtilential vapours ever been obſerved to ariſe out of the pits on the *Sambian* coaſt; white amber well poliſhed is good in catarrhs, the yellow ſort rubbed on the eyes does them great ſervice; and little balls of it are alſo uſed in iſſues; daily experience confirms that its powder is very ſerviceable in provoking urine, expelling the ſtone, and promoting the *Menſes*; and in theſe caſes the white ſort is the beſt becauſe there is moſt ſalt therein.

It would be tedious to relate the ſeveral pharmaceutical remedies prepared from amber; the reſinous magiſtery thereof in pills is uſed with ſucceſs, and not inferior to the balſam of *Capivi*, either in provoking urine, digeſting phlegm or moderating a gonorrhœa, it is alſo proper in cephalic plaiſters; the colophony thereof is good in diaphoretic and ſtomachic plaiſters; and uſed with great ſucceſs, and at a ſmall expence when applied to ſtrengthen the parts in a palſey, apoplexy, epilepſy or gangreen; it cheriſhes joints weaken'd by the gout; the oil of amber is a noble medicine both in *Europe* and *Aſia*; tho' by the unſkilfulneſs of quacks it has loſt its reputation, being fatal to patients afflicted with the ſtone, gonnorrhœa and a ſuppreſſion of the *Menſes*; a drop or two of it imparts a virtue to ſeveral drachms of ſugar; a ſingle drop rubbed on the vertex or ſutures of the head cures a cold phlegmatic brain; cotton dipped in it, and put into the ears cures their tingling; it reſtores parts mortified with cold; it is uſeful in hard labours, and is well known even to the horſe-doctors in *Pruſſia*, tho' they uſe the powder moſt; the beſt oil is what is volatile, without any empyreumatic twang, and what is white, is very ſubtile and fragrant; the volatile ſalt of amber is not only very much cried up in epilepſies, and other cephalic diſorders ariſing from phlegm, but is alſo an excellent diuretic; the eſſence of amber is the more ſubtile part of the oil, which you may uſe with the ſame ſucceſs; but as it is diluted with a mixture of ſpirit of wine a large quantity may be taken; it is alſo good in driving a gangreen outwards; ſome reckon its phlegm medicinal; but whatever virtues it has is owing to the remainders of oil and ſalt therein, without which it is inſipid, and frothy; the groſs oil that diſtills laſt is uſed by the common people in the cure of chilled joints; but when it has got a twang from the fire,

it ſmells ſtrong, ſo that it is better to forbear it and preſerve the colophony in its full virtue; preparations of amber may be made to give relief almoſt in all diſtempers. M. *Hartman* in a regular analyſis, where he followed nature, by ſeparating with a gentle fire the pure from the impure parts, did ſo unite all the virtues of amber, that preſerving its native fragrancy, together with the efficacy of its fat and ſaline particles, it became a medicine proper both in internal and external caſes; he calls that the balſam of amber, where the ſtrong ſcented parts of earth are ſeparated, and the more volatile and delicate ones cohere ſo cloſely together that they admit of no foreign particles; whatever effects can be expected from crude amber, or any artificial preparation thereof, the ſame may be performed ſooner, more ſafely, and more agreeably by this balſam; the beſt way of taking it inwardly is in pills or bolus's; it is applied externally like the apoplectic balſam, which it reſembles in colour; it is uſed with ſucceſs in fainting, hyſteric, epileptic, and paralytic diſorders, by rubbing the patients gums, tongue and palate with it; for prevention it may be ſafely taken twice or thrice a week to the quantity of five, ſeven, ten, and even fifteen grains; and in like manner it may be taken in ſome diſorders of the kidneys, bladder, *&c.* if you mix anodynes with it; for a tingling in the ears it is a more infallible remedy than the oil, whoſe diſagreeable ſmell, the hazard in uſing it, as being of a fiery nature, and its being deſtitute of volatile ſalt put M. *Hartman* on inventing this balſam; and it is not without reaſon that *Hoffman* and *Etmuller* mix the agreeable ſcent of the *Peruvian* balſam with the oil of amber; but it proves more ſucceſsful to mix the *Peruvian* balſam with that of amber by M. *Hartman*, eſpecially in a *Gonorrhœa* and *Fluor Albus*.

A retort is the fitteſt veſſel for diſtilling amber; when you would extract the ſalt, white amber is beſt, and the yellow ſort when you would have the oil: M. *Hartman* had an ounce and a half of volatile ſalt out of a pound of the white, and ſcarce a drachm out of a pound of yellow: Your diſtillation will ſucceed more ſucceſſively, if you uſe clean and poliſhed fragments, and of a thin and tranſparent rind, than if you take ſuch as are either impure, of a coarſe cruſt, or the common ſhavings; you muſt mix nothing with the amber, tho' formerly it was uſual to put flints and ſand with it; you muſt not give it a ſtrong fire, the heat is gradually increaſed by the ſand; by due management there preſently ariſes with the phlegm the æthereal portion of the oil; when a yellowiſh oil comes over with the volatile ſalt, proceed no farther in the diſtillation: The amber may be ſtill urged till it yields

yields a groſs black liquor, and what remains will be a little black *Caput Mortuum*, like a ſhining colophony, but deſtitute either of oil or ſalt; out of a pound and a half of white amber, there was left an ounce of this *Caput Mortuum*; the volatile ſalt that aſcends to the top of the veſſel, or ſticks to its ſides is to be waſhed off with warm water, and in order to ſeparate it from the oily particles mixed therewith, ſtrain the ſolution thro' a wet paper, and the ſalt paſſes thro' whilſt the oil remains behind, then evaporate the ſuperfluous moiſture from this filtred ſolution, until there remains about the third part, which being expoſed to the cold air, it ſhoots into cryſtals of ſalt, in the form of millet-ſeeds.

There is another method of depurating the ſalt, which is by putting the lees into a long necked glaſs, laid in a heat of aſhes or ſand, the white flakes, or little ſhoots, fly to the top, whilſt the groſſer part remains at bottom; but this operation is attended with the loſs both of the glaſs and ſalt together; ſome endeavour to ſeparate the phlegm; but it is better put into the water that imbibes the volatile ſalt, that it may likewiſe be diveſted of its ſalt; nor does repeated diſtillation give it any virtue, unleſs it receives it from the volatile ſalt; nor is the ſmell of the phlegm ſo agreeable as to preſerve it. M. *Hartman* extracted from a pound and a half, an ounce and a half of white phlegm, of the taſte of ſalt of amber, but upon repeated diſtillations it ſavoured only of ſmoke, and was beſides of a diſagreeable taſte; there is ſome ſalt in the colophony, if it is not quite burnt, which you may extract by macerating it with warm water for ſome time; ſome reckon this a fixed ſalt of amber; but what ſort ſoever of ſalt this is, it adds to the virtue of the colophony; there is no occaſion to depurate the oil by another operation, for providing the recipient is changed in due time, and the diſtillation properly ſet about, you have the pureſt directly; the qualities of the oil of amber are to be derived from bitumen, or the oil of the earth, wherein M. *Hartman* agrees with *Borrichius*, but differs with him in that he would have all the virtues of the oil of amber to be common to *Petroleum*; there is no amber of whatever colour, without its volatile ſalt, from which ariſes its peculiar fragrancy, and the more ſalt it abounds in, the more fragrant you find it upon rubbing; tho' M. *Hartman* maintains, that the ſalt of amber is moſtly compounded of vitriol of iron, which is plainly perceived both by the ſmell and taſte in the white ſort that abounds very much in volatile ſalt, yet he does not aſcribe ſalt of amber to common vitriol.

That

That this volatile ſalt ariſes from an acid, its acid vinous taſte, which is not diſagreeable, plainly ſhews; and this pleaſant tartneſs of the volatile ſalt of amber comes the neareſt to the philoſophic ſpirit of vitriol; it is pungent, but not corroding; it neither ferments nor bubbles upon pouring ſpirit of vitriol upon it, nor does it waſte, when mixed with *Sp. Sal. Armon.* it raiſes little bubbles with a hiſſing noiſe, and is abſorbed by it; M. *Hartman* aſcribes the very ſubtile and agreeable volatile acor in ſalt of amber to bituminous exhalations, as ſpirits of wine mixed with ſpirits of nitre or ſalt temper them ſo, as to be denominated ſweet; for whilſt the ſubterraneous heat unites the diſperſed particles of bitumen, it happens that theſe in their paſſage thro' the beds of vitriol, by means of the ſame heat ſublimate and carry along with them the moſt ſubtile effluvia of vitriol, and that in a greater or leſs quantity, ſo that, by their coalition in the woody matrix, amber is produced.

The proceſs of reducing amber to a fine powder is eaſy; for it matters not, whether you grind or beat it ſmall, both ways it is of ſervice, as appears from the inſtance of beaſts before-mentioned, that greedily ſwallow down little bits of amber, and by being made ſmall, it is diſpoſed to mix the more readily with the native juices of the animal, on which account this operation may be of great ſervice in phyſick: When amber is boiled in wine, it imparts its virtue to it, which it likewiſe does when infuſed and digeſted therein; ſpirits of wine poured upon amber produce the eſſence or tincture thereof, which is not tinged yellow, from the pure white ſort; whether it is better to uſe the ſpirits of wine rectified or diluted is a queſtion, the oily parts require the former, and the ſaline the latter, yet amber yields to both, and becauſe whatever time the digeſtion takes, the ſpirits muſt be diluted at laſt, therefore uſe the highly rectified; the tincture is extracted the more readily, if you put filings to the ſpirits; others add the oil of tartar *per deliquium*, or of fixed nitre, to ſharpen the ſpirits, that the greater virtue may the more quickly be communicated to them, which might do very well, if no foreign particles were thereby added to the tincture; the amber diſſolves the more readily if put to digeſt in a glaſs with a long neck, and it ſoon imparts its virtue to the ſpirits, which are entirely ſaturated therewith, and this is obtained only by digeſting it for ſome time.

M. *Hartman* having pounded ſome pieces of the foſſile wood, and macerating it in hot water, the lee taſted ſweetiſh like allum or iron, but very little of vitriol; but thickening it in order to collect

collect the ſaline cryſtals, it ſavoured more and more of vitriol, and even the cryſtals themſelves did ſo, only that the ſweetneſs of iron was the firſt taſte that was felt on the tongue, and this was confirmed by repeating the ſolution, and collecting a ſecond time the little cryſtals; he put the wood, diveſted of its ſalt, into a retort, which he laid in ſo ſtrong a ſand-heat, that the matter within the glaſs was red hot, and thus he extracted all its moiſture; the milky liquor, that diſtilled from it, was like an emulſion of almonds; it had afterwards a little pellicle on the top, and the calciform particles ſubſided to the bottom; there was a very ſtrong ſmell of ſulphur felt all over the ſtove, but upon bringing the liquor nearer the noſe, he perceived it ſmell a little of amber; not like the fragrant glebe, or oil, but like the ſmell of the phlegm that remained in the retort after diſtillation; it taſted alſo of ſmoke like the phlegm, with ſomewhat of a ſaltiſh acor; the milky colour afterwards diſappeared, leaving behind it a fat ſcum; he expoſed a ſecond time part of it to the fire, to ſee if by repeated diſtillation he could obtain any volatile ſalt, or any of the purer drops of oil, but no ſalt aſcended, and the more ſubtile oily particles floated upon it, cohering no longer in the form of a ſcum, whilſt ſome of them ſunk to the bottom in the form of tranſparent globules, of a fiery amber-colour; a few drops of oil were extracted from a pound of liquor, which very much reſembled, both in taſte and ſmell, oil of petre; the globules, tho' they appeared reſinous at bottom, were mixed with the liquor by a gentle ſhaking of the veſſel, and the calx, which was the finer earthy particles, was ſublimed by the force of the fire; the wood, when taken out of the retort, was of the colour of ruſty iron, it ſmelled ſtrong of ſulphur, and put into the fire it burnt like fuel; its ſurface was ſprinkled with a red kind of powder.

He put it into a crucible for three hours in the fire, and when it cooled, it was covered over with a powder like cinnabar; it did not take fire readily, nor retain it long, nor ſpread itſelf like fuel; it ſmelled like ſulphur, and had its taſte; when ſet on fire it ſmelt leſs of ſulphur than what was left behind in the retort, it was alſo of a brighter colour; again, he kept it above nine hours in the crucible, but it would not take fire any more, and after being calcined, it appeared white like *Amianthus*, without any ſmell of ſulphur; by ſtanding ſo long in the crucible, its colour was partly a greyiſh black, and partly ſhining; ſome parts appeared by the microſcope like droſs, others like borax, and ſome like a calx.

Native

Native vitriol, rubbed with ſteel, ſhewed that it came nearer the nature of iron than copper, having nothing of the redneſs of copper in it; which the native vitriol, like *Amianthus*, diſſolved and ſhot into cryſtals does alſo confirm; for it has at firſt a ſweetiſh iron-taſte like that of the ſalt or ſolution of iron; the cryſtals do not ſhoot like thoſe of *Goſſer*; having firſt depurated the ſolution by pouring urine into it, and removing the *Fæces*, there came a foliaceous ſort of earth, and the remaining liquor preſented to the view cryſtals almoſt of the colour of ſaphire, and of unequal angles; after the ſolution grew thicker, was filtered and evaporated, it yielded a white oil, which being put into a retort, and gently calcined in an oven, it produced in 24 hours very good ſpirits of vitriol, ſuch as are prepared in the ſhops of the oil of *Mars*; by a microſcope, M. *Hartman* diſcovered a good deal of ſalt ſtill remaining in the *Caput Mortuum* of the oil, whence may be underſtood in what manner the oil contained in the *Caput Mortuum*, when expoſed to the air, may be reduced again: Several trials made by fire confirm, that the barky earth is of the ſame nature with the foſſile wood; it muſt be roaſted gently before any metal can be extracted out of it, tho' what is found therein is but very little; he alſo diſtilled from the blue clay a volatile ſpirit of a ſulphureous and bituminous ſmell, and which floated a-top; he found that the yellow earth inclined ſomewhat to the nature of iron, and both its taſte and ſmell ſhewed that it had borrowed ſome tincture from vitriol.

The Generation of Fleas; *by* S. Diacinćto Ceſtone. Phil. Tranſ. N° 249. p. 42.

FLEAS bring forth eggs, or a ſort of nitts, from which are hatched worms, that make bags for themſelves, like thoſe of ſilk-worms, out of which bags come fleas; they depoſite their eggs on dogs, cats, men, and other animals that are infeſted with them, or in places where they ſleep, which being round and ſmooth ſlip commonly down to the ground, or fix themſelves in the folds and other inequalities of the coverlets and cloaths; from theſe are brought forth white worms of a ſhining pearl-colour, that feed on the bran-like ſubſtance which ſticks in the combs, with which puppies are combed to take out the fleas, or on a certain downy ſubſtance found in the folds of linen-drawers, or in other ſuch like things; in a fortnight's time they come to the bigneſs of Fig. 1. Plate X. and are very lively and active; if they are under any fear, or if they are touched, they roll themſelves up of a ſudden, and make as it were a ball; a little after they

they come to creep, as silk-worms do that have no legs, with a very brisk and swift motion; when they come to their usual bigness, they hide themselves as much as they can, and with the silk they spew out of their mouths, they make a small bag round themselves, which is on the inside as white as paper, but on the outside is always dirty, and fouled with dust; the bags appear to the naked eye of the bigness of Fig. 2. In two weeks more in the summer-season the flea is perfectly formed, then it soon leaves its *Exuviæ* in its bag, as silk-worms and all catterpillars do; the flea, all the time it is inclosed in the bag, is milk-white, and has legs; but two days before it comes out, it becomes another colour, grows hard, gathers strength, so that upon coming out it leaps streight away.

Fig. 3. represents the eggs; Fig. 4. the worm; Fig. 5. the bag; Fig. 6. the flea; but all magnified by the microscope.

Two clear inflammable Liquors, *which upon Mixture give a* Carnation Colour; *by Mr.* Geoffery. Phil. Trans. N° 249. p. 43.

TO make the first of these liquors, put a small handful of dried red roses into a glass-bottle, pour on them rectified spirits of wine to the height of an inch; let them infuse for four or five hours in the cold, then pour off the spirits, which will be clear and colourless.

The second liquor is made by putting some drops of good spirits of vitriol, or oil of sulphur, into good spirits of wine, so that the acid taste can scarce be felt by the tongue; if you put a little of this last liquor into the first, it will give a fine reddish colour, without any effervescence or other sensible alteration; if instead of this wine mixed with acids, you put to the first some drops of any volatile alkalies, as of spirits of *Sal-armoniac*, or any such, it will give a green colour to the infusion.

Seeds *to clarify Water*; *by* Hans Sloane, *M. D.* Phil. Trans. N° 249. p. 44.

THESE seeds come from the coast of *Coromandel*, or *Malabar*, they are about the bigness of a small pea, only broader and flatter, having *Striæ*, or creases, running from their centre after the manner of the common *Nux Vomica*; in the *East-Indies* they rub or grate them on the bottom of a small earthen bason, wherein is contained some water; this water and powder are put into a large quantity of muddy or foul water, and it is clarified thereby.

A Comet, Anno 169$\frac{9}{10}$, *at* Paris; *by M.* Caſſini. Phil. Tranſ. N° 250. p. 79. *Tranſlated from the* Latin.

UPON the night following the 19th of *February*, in the year 1699, at the royal obſervatory at *Paris*, there began to appear between the opening of the clouds, that for ſome days paſt had overcaſt the heavens, a ſmall comet like a nebulous ſtar of the third magnitude, like that which was obſerved in the month of *September* 1698; it was ſituated among the *Stellæ informes* of the ſixth magnitude near the arctic circle, above the head of *Auriga*, almoſt in the middle between the occidental cubit of *Perſeus* and the head of *Urſa major*, which *Tycho* reckons in the number of the *Stellæ informes* about *Urſa minor*; by repeated obſervations from that night to the next following, the motion of the clouds laying open that region of the heavens, it appeared to have a proper motion, and to direct its courſe towards *Capella*, with little or no deviation from the circle of its declination; and had not the ſky been overcaſt the preceeding days, it might have been ſeen near the north *Pole*; its velocity was ſuch, that in a day's time it had accompliſhed about ſeven degrees of a great circle, by which motion it might in leſs than four days almoſt reach the *Pole*, and be aſſociated with the polar ſtar; he compared this comet with a ſtar of the ſixth magnitude which *Tycho* calls the ſecond of thoſe that are in a right line with the *Pole*, and found that in paſſing thro' the horary circle it had got the ſtart of this ſtar by 15′ 53″, to which is owing the difference of its right aſcenſion being 4° 43′; for it was more northerly than that ſtar by 8′; from whence the longitude, from the latitude aſſigned this ſtar by *Tycho*, being computed at this time, the comet may be referred to 15° 51′ of *Gemini*, with 37° 25′ north latitude: It moved in the region of the heavens oppoſite to that wherein the comet of the preceeding year had done, when almoſt at the ſame diſtance from the *Pole* as this appeared in at firſt, and pretty near the ſame place.

The comet in *September* went in the ſame tract that that obſerved by *Caſſini* at *Bologna* did in the year 1652; this latter in the month of *December* came from the ſouthern regions, thro' the conſtellations *Lepus*, *Orion*, and *Taurus*, where it interſected the ecliptic in an angle of 76° of inclination, and thro' *Perſeus* and *Caſſiopeia*, where it diſappeared in *January* 1653, whilſt the preſent comet firſt appeared in the beginning of *September*, in the ſame part of *Caſſiopeia*, wherein the other diſap-

disappeared, and from thence proceeding thro' the shoulders and arms of *Cepheus*, where it had its greatest latitude from the ecliptic, *viz.* 76°, it passed between the *Dragon* and *Swan*, over the skin of the *Lion* in *Hercules*, and over *Ophiucus*, till it came to the constellation *Scorpius*, where, according to the observations made, it continued from the 24th to the 28th of *September*; by the same observations, he found that it had come to its *Perigæum* the 7th of *September* in the evening, having a very great apparent velocity of almost 10° in a day.

Virtues of the Ostracites; *by Dr.* Cay. Phil. Trans. N° 250. p. 81.

DR. *Home* gave him an account, that he never used the *Ostracites* in any case where he knew the patient was troubled with a confirmed stone (being persuaded that no medicine can break a large stone) but only to such as were afflicted with gravel or small stones; that some of his patients were cured without evacuating any gravel or stones at all; that others evacuated both; that it never does its work of a sudden (not being remarkably diuretic) but dissolves rather than expels the little stones; that none he ever gave this medicine to, however grievously and frequently afflicted before, had ever been troubled with nephritic pains since; that his manner of giving it was in fine powder mixed with about a third part of the flowers of cammomil; and the dose he gave, was from half a dram to a dram put in white wine; that the greatest dose is often apt to offend and nauseate the stomach; that he gave it once alone, and a weak infusion of cammomil flowers in white wine after it, but this did not so well. This shell, which Dr. *Cay* takes to be the same with Dr. *Lister*'s *Ostracites maximus rugosus & asper*, burns to a lime as other shells do, and as the *Selenites* (tho' weakly) does; it yielded no volatile salt, tho' he tried it in a naked fire; nor do common oyster-shells, when fresh taken and used, afford out of four ounces, above half a scruple of liquor, somewhat urinous, and possibly, if long dried and exposed to the weather, they would lose even that, and yield no more volatile salt than the *Ostracites:* Some say that the other shells, that are commonly called petrified, yield a volatile salt; and the Doctor himself had from the shells of crustaceous fishes, particularly lobsters, a volatile salt and fetid oil in great quantity, even in a sand furnace; but these sort of shells differ from other shells, as Dr. *Lister* has well observed in this too, that in these the

knob bends a little towards the hinge or end, whilſt it is otherwiſe in oyſter-ſhells; they differ too in their ſpecific gravity, theſe being more ponderous than the other, and ſomewhat near the ſpecific gravity of the *Selenites*; he obſerved likewiſe ſome ſuch difference among the *Cornua Ammonis*, having had one or two ſmall ones from the coal-pits, that had a conſiderable mixture of the *Pyrites*; whereas theſe that are found about *Whitby* approach more, he thinks, to the nature of allum-ſtone.

The Virtues *of* Faba St. Ignatii; *by Dr.* Sloane. Phil. Tranſ. N° 250. p. 87. *Tranſlated from the* Latin.

NUX Pepita or *Faba S. Ignatii* is about the bigneſs of a nutmeg and triangular; this fruit is very much eſteemed in the *Philippine Iſlands* where it grows. 1. It has the ſame virtues as the metal we call *Tumbaga*, and that compound denominated *Ilingo*; it preſerves from poiſonous ſteams, from ſpaſms, eſpecially a particular ſort of cramp called *Sotan*. 2. It helps to vomit up any poiſon, if its filings are drank in cold water, and it likewiſe does ſervice in the bites of venemous creatures, by applying ſome of the filings to the place affected. 3. As alſo the filings applied in like manner, relieve any member of the body afflicted with the cramp. 4. And the ſaid filings ſtop the bleeding of any wound, and being given to drink to a woman that had long been under a flux of blood ſhe was preſently cured. 5. It cures fevers, as was confirmed in the caſe of an infant labouring under a violent fever, which was removed as ſoon as it had ſome of it in its drink. 6. It aſſiſts women in child bearing. 7. In fine, daily experience proves its wonderful virtue in diſpelling repletions and crudities in the ſtomach, and beſides in moderating a frequent deſire of going to ſtool. As to the manner of uſing this medicine:

Divide each nut into three parts, and when there is occaſion for it, let the patient put it into his mouth for a quarter or half an hour, let him ſwallow the ſpittle, and afterwards drink about two or three ounces of cold water, and he will find the good effects of it; or thus,

Take a very hard piece of ſhell, in the hollow part of which put a little water, and therein rub hard the fruit, and pour that water with the filings into ſmall veſſels, repeating the preparation three or four times, until you have two ounces of the confection and lotion made of the piece of ſhell and

and nut, which you muſt ſhake before you give it the patient to drink.

Or thus, divide a nut into ſmall pieces, fry it in oil, eſpecially oil of olives, and let the patient drink it, or let it be applied to the place affected, or rubbed over the parts ſeized with the cramp, and it has the ſame effect as above.

The ſame by P. Geo. Camelli. Phil. Tranſ. N° 250. p. 88. *Tranſlated from the* Latin.

Catalongay, by others called *Cantara*, is a plant that bears the true *Nux Vomica* of *Serapion*, and which winds round the higheſt trees; the trunk is woody, light, porous, and ſometimes as large as one's arm; the bark is rough, thick, and of the colour of aſhes; its leaves are broad, full of fibres, and bitter, very near like that in Fig. 7. Plate X. the fruit is larger than a melon, and the flower like that of a pomegranate, being covered with a very fine rind, that is tranſparent, ſmooth, and of a pale or alabaſter colour, under which is another rind of a ſubſtance as hard as ſtone; under this and within a bitter, yellow and ſoft pulp, like that of the fruit *Manga*, the true *Nuces Vomicæ*, which when freſh ſhine white like ſilver, by reaſon of a down they are covered withal, and not quite ſo large as a walnut, and of various ſhapes, to the number of 24 grow in a cluſter; the *Indians* call it *Igaſur* and *Mananaog*; the *Spaniards*, *Pepitas de Byſagas* or *Cathalogan*, and others *Faba S. Ignatii*; when dried it is as large as a filbert with its ſhell on, or ſomewhat larger, being knotty, very hard, tranſparent and as it were of a horny ſubſtance; it has a much more bitter taſte than the ſeed of citron, and according to *Serapion* is between a white and ſky-colour.

M. *Camelli* made a patient of a melancholic conſtitution take one ſcruple of the powder of *Igaſur* for a vomit; being troubled with a flux, weak digeſtion and frequent vomiting, with four belchings, as alſo with a great deal of wind, which he no ſooner took than he was ſeized with a trembling all over his body that continued three hours together with an itching, and terrible convulſive twitchings, ſo as not to be able to ſtand upon his legs, the convulſion was moſt violent and troubleſome in his jaws, ſo that ſometimes he was forced to laugh, without any remarkable alteration in his pulſe, vomiting or any other ſymptoms attending it; at length he found himſelf ſomewhat better: Another patient had the like trembling and convulſions, together with a very great oppreſſion in his breaſt, a ſwiming in the head,

head, fainting, and cold ſweats; and being hypocondriacal, in order to cure himſelf, he ſwallowed a whole freſh nut; but M. *Camelli* relieved him with warm oxymel and oil, by which he threw up a great deal of viſcous phlegm with the particles of the nut: Another had taken the third part of a nut and was for three hours in the like caſe with the two former, only that beſides involuntary convulſions, he felt a tingling pain and the like, eſpecially in his head. There's no doubt but that ſometimes from ſuch a violent commotion in the animal ſpirits and alteration of the humours occaſioned by this nut, may be thrown off all heterogeneous particles with thoſe of this dangerous medicine, whereby the humours are reſtored to a better temperament, and deſired health enſues. The common way of uſing the nut *Igaſur* is by infuſing it whole in hot water till it becomes bitter, and then pouring the liquor off; ſome preſcribe a ſmall quantity of it in powder, others give one or two ſmall pieces to ſwallow down, ſome the whole nut, and others wear it about their neck by way of amulet: It often cauſes vomiting and ſometimes gives a ſtool; the *Spaniards* are almoſt generally thrown into convulſions by it, but the *Indians* never; it is to be taken in caſe of poiſon, and immoderate commotions of the ſpirits without regarding the time; in other accidents and diſorders it is to be given the patient in the morning faſting; but when it is deſigned for a vomit it is more proper to take a doſe of a ſcruple and a half, an hour or two after meals, together with other gentle vomitives.

A little bit of the nut, or ſome of the filings is good againſt the bite of the viper *Baſul* a kind of worm that, upon touching a perſon, cauſes a violent itching, and of other poiſonous animals; *F. de la Zarza* told M. *Camelli* that when applied to the wound made by a dart or any infected weapons, it extracted the poiſon like the *lapis Culebrinus*; others recommend its powder for ſtopping the blood in hæmorrhagies, and in apoplexies, palſies, lethargies, epilepſies, in aſthma's, catarrhs and other defluxions; a little bit of it put under the tongue provokes ſpittle, and frees the head of a viſcous phlegm; its powder, and an infuſion of it, or the oil deſcribed below, adminiſtred in a tertian or quartan fever is much commended; it is found of ſervice in provoking urine, as alſo on a ſuppreſſion of the *Menſes*, hard labour, and expelling the ſecundines, a dead *Fœtus* and the worms; beſides it is given in cholics, indigeſtion, bad concoction and crudities in the ſtomach, in a diarrhoea, teneſmus, an obſtruction in the liver and ſpleen; an

oil

oil prepared from the ſimple infuſion of the nut is a very ſtrong emetic, and ſerves for the ſame purpoſes as the nut itſelf; moreover it aſſiſts concoction and recovers loſt appetite.

The decoction of *Manungal* relieves in all caſes of poiſon, and the biting of poiſonous animals; it is a febrifuge and an anti-aſthmatic; it removes inveterate obſtructions, and reſtores loſt appetite; beſides that, being taken in the morning for eight days together it cures the yellow jaundice, it expels worms and gives relief in the cholic; two drachms of the decoction give almoſt five ſtools: The doſe of the powder of the vomiting bark *Manananangtan* is from one ſcruple to four; it evacuates ſtrongly, both by vomit and ſtool, phlegmatic, tough and choleric humours; from whence it is given with ſucceſs in fevers, repletion of the ſtomach, an exceſs of viſcous humours, a cachexy, and dropſy; this, with the decoction *Manungal*, is very good in all caſes of poiſon, and in expelling worms; Fig. 8. Plate X. repreſents the leaves, Fig. 9. the flowers, and Fig. 10. the fruit of this plant.

Stones *found in the* Stomach, Kidney *and* Gall-bladder; *by M.* Will. Clark. Phil. Tranſ. N° 250. p 95.

AN. 1690. a lady, who, by the advice of her phyſicians, had been drinking the waters at *Moffet Wells* in *Annandale* in *Scotland* for a continual vomiting, and nephritic complaints, died there in a fit of vomiting; upon diſſecting the ſtomach Mr. *Clarke* found a ſtone of the form and bigneſs as in Fig. 11. Plate X. the corner *a* was almoſt fixed in the *Pylorus*, ſo that the paſſage from the ſtomach to the inteſtines was almoſt quite ſhut up; the ſubſtance of this ſtone was a little ſpongy weighing about 8 ½ drachms; in the left kidney he found alſo a ſtone of the ſame ſubſtance weighing about five drachms, and in the gall-bladder he found ſeveral ſtones weighing two drachms.

That ſtones are daily generated in the *Veſica Urinaria*, reins and *Veſicula Fellis*, is a thing very common, but not ſo in the ſtomach of a human body; however, it ſeems they have been produced by the ſame common cauſe and from the ſame petrifying matter: Mr. *Clarke* thinks that ſome extraneous body gives origin to that in the ſtomach, as it frequently happens even in thoſe extracted from the *Veſica Urinaria*; thus an iron tag, a leaden bullet, *&c.* have been found to be the kernels of ſeveral ſtones; and that ſeveral extraneous bodies are oftentimes found in the ſtomach, which have been ſwallowed down either

either willfully or by accident, we have the authority of *Sennertus* and others; one Mr. *Cameron* an epiſcopal Divine in *Scotland* in a frolick ſwallowed half a crown and found no inconvenience thereby; and amongſt the rarities in the anatomy hall at *Leyden* there is preſerved a knife ten inches long, which was cut out of a peaſant's ſtomach, and he lived eight years after it. Stones generated in the ſtomach excite horrid pains; but there are ſcarce any clear ſigns by which they can be diſtinguiſhed from others, except the continuance of the pain; ſometimes they are ejected by vomit, and ſometimes they adhere to the bottom of the ſtomach; that ſtones are alſo formed in all other parts of the body, we are aſſured by manifold obſervations and experience, as in the brain, kidneys, ureters, gall-bladder, at the root of the tongue, knee, even in the heart itſelf, and in the nerves: But ſtones are more commonly formed in the kidneys and bladder, becauſe theſe veſſels are more properly deſigned to ſeparate and contain the *Serum* of the blood; and for that reaſon ſtones in the reins and *Veſica urinaria* are more troubleſome to perſons afflicted therewith, than in any other part of the body. 1. Becauſe the parts are more ſenſible. 2. Becauſe they ſtop the paſſage for evacuating the *Serum* that is continually ſeparating from the blood, and by conſequence diſtend the veſſels, which occaſions horrid pains.

Stones are not only found in human bodies, but alſo in ſeveral parts of other animals, as bezoar-ſtone in the ſtomach of a ſort of goal in both the *Indies*, as alſo in the ſtomach of monkeys, which is eſteemed the beſt; there is alſo a kind of bezoar, called cow-bezoar, found in the ſtomach of a cow; *Hippolithus* found them in the ſtomach of horſes; *Ægagropila* in the *Capra Alpina*, &c.

A new Way of cutting for the Stone; *by a* Hermit *in* France, *with Obſervations by M.* Buſſiere. Phil. Tranſ. N° 250. p. 100.

BRother *James*, a Hermit in *France*, in extracting the ſtone out of the bladder, uſes a ſteel ſtaff much bigger and ſhorter than thoſe which are commonly made uſe of, it is ſhorter from the top to the bending of it, and it bends more than ours; his *Conductor* is ſlenderer, and longer than ours, the point that goes into the bladder being of the figure of a lozenge, is wide and open in its extremity; his *Forceps* has longer branches than ours, but the holds of them are ſhorter and

and wider, having many large teeth within; the *Urethra*, with which he draws the ſand, or gravel, that remains ſometimes in the bladder after the ſtone is out, is ſhorter than ours; his knife is much longer and ſlenderer than ours.

He cauſes the patient to lie flat upon his back, either upon his bed or upon a table, whereon is a ſoft quilt in ſuch a manner that the fundament is three or four fingers over the table, while ſome ſervants ſupport his thighs and legs; he uſes no ligature, but only cauſes his legs to be bent againſt his thighs, but not the thighs againſt his belly, except the left, which in the operation he uſes more or leſs, as he thinks proper; then he introduces the catheter, or ſtaff, into the bladder, which tho' bigger and ſhorter than ours, yet ſeems to run in eaſier; very often he holds it himſelf in his left hand, preſſing it cloſe towards the fundament, in order to dilate and extend the membranes of the bladder; then he feels with the fingers of his right hand to find out the ſtaff thro' the ſkin, and having felt it, he runs his inciſion-knife at the bending of the left thigh upon the fat protuberance below the *Iſchium*, directly upwards by the *Rectum* to the bladder, which he pierces at the neck, and ſometimes a little above it; when he performs, the cutting parts of his knife are turned upwards and downwards; having thus pierced the bladder, which he knows by the urine running out, he turns his knife, and thruſts a little further, in order to open the bladder wide enough, that his finger may go in eaſily, then withdrawing his knife, he enlarges the wound in the outward parts two or three inches long, after which he thruſts his finger into the bladder, in order to know more preciſely the bigneſs and ſituation of the ſtone, and make it looſe, but chiefly to dilate the aperture of the bladder by tearing its membranes, then he introduces his *Conductor* into the bladder along his finger, which is within it; when the *Conductor* is in the bladder, he takes the ſtaff out, and introduces the *Forceps* by the *Conductor* into it, with which he gets hold of the ſtone, and draws it out; if he finds any difficulty either in getting hold of the ſtone, or in drawing it out, he takes all the uſual methods, as raiſing the left thigh more or leſs, putting his finger into the fundament, and ſometimes into the bladder to looſen it, in caſe there be any adheſion with the membranes; having found out, and removed the cauſe of the difficulty, he thruſts the *Forceps* again into the bladder, gets hold of the ſtone, and extracts it.

It is to be obſerved, that he uſes no *Conductor* the ſecond time, nor at any other, the *Forceps* running in very eaſily; he never thruſts either his finger or any inſtrument into the bladder, without ſteeping them in oil of roſes; he never uſes any *Dilatorium* or *Cannula*, or tents in the wound, except ſometimes ſmall doſſils in the lips of the outward wound, to keep them open for a little while; he only applies a pledget, ſteeped in oil of roſes, upon the wound; he operates this way as dexterouſly as any of our beſt operators; he very often cuts the patient upon the gripe, almoſt in the ſame manner as was uſed formerly, except that he makes the inciſion in the ſame place as is done for the former; this way he likes better than the other, and indeed it is ſurer, tho' his preſſing upon the belly is a very bad method; he cuts women alſo upon the ſtaff, and in the ſame place as men, only that he cuts the internal neck of the *Uterus*; but in M. *Buſſiere*'s opinion, that way either in men or in women is not ſo ſure as the ancient method, by reaſon that the point of the knife, not being directed by the ſtaff, he is always in danger of piercing all the membranes of the bladder thro' and thro'; and beſides, the place whereupon he makes the inciſion being full of conſiderable veſſels, one can hardly avoid the cutting ſome of them; he obſerved in almoſt all that died in the Hermit's hands, that there was a great deal of blood in the bladder, and ſome in the cavity of the *Abdomen*; he ſucceeds better when the ſtone is big and large, than when it is ſmall, by reaſon that a big ſtone not only extends the bladder, but it ſtops the point of the knife; and when there is but a ſmall ſtone, the bladder being empty, he muſt neceſſarily cut it throughout, and conſequently ſome of its veſſels, which cauſes the hemorrhage, that is better avoided when the ſtone is very large.

M. *Buſſiere*'s obſervations upon this way of operation are theſe; he took a body, in the bladder of which he put a ſtone; the ſtaff being in the bladder, he preſſed it downwards, hard enough to be felt thro' the teguments, and made the inciſion upon it in the bent of the thigh, in order to know whether it would not be a ſurer way, by ſecuring the point of the knife; by that means he got his *Conductor* and *Forceps* into the bladder, and extracted the ſtone very eaſily; but afterwards, by the diſſection of the body, he found that the artery of the *Penis* and the *Veſiculæ ſeminales* were cut thro' and thro', which cannot be avoided, becauſe the artery and *Veſiculæ* lie immediately

diately under that part of the bladder which the ſtaff preſſes upon.

He took another body, and having put in the bladder a ſmall ſtone, he made the inciſion much lower, piercing the bladder under the ſtaff, by which he extracted the ſtone; then diſſecting the body, he found that the bladder was cut thro' together with its arteries, which can hardly be avoided, by reaſon the bladder is ſo much contracted there, that both ſides of it are cut before the operator either feels the ſtone, or ſees any urine running out.

He took a third body, in the bladder of which he put a very large ſtone; the ſtaff being in it, he made the inciſion upon the fat protuberancy under the *Iſchium*, and piercing the bladder below the ſtaff, he immediately found the ſtone with the point of the knife, with which he cut the bladder the length of an inch, thro' which having introduced the *Conductor* and then the *Forceps*, he got hold of the ſtone, and drew it out very eaſily; afterwards diſſecting the body, he found that neither the *Veſiculæ ſeminales*, nor any artery, had been cut, by reaſon that the weight of the ſtone preſſed the bottom of the bladder lower than the *Veſiculæ* and arteries.

M. *Buſſiere* thinks, that this way might be made uſe of when the ſtone is very large, and he prefers it to the old way; becauſe by this means is avoided that extraordinary and violent dilatation of the neck of the bladder, which the ſtone cauſes when it is very large, and is the cauſe of the inflammation and mortification of the bladder that kills the patient; but when the ſtone is ſmall, or but of an indifferent bigneſs, the old way is eaſier and ſurer; but he does not approve at all of the Hermit's new method on women, ſince one cannot avoid cutting the neck of the *Uterus*, which might prove to be of ſome ill conſequence, in caſe the woman ſhould come to be with child; and therefore, when the ſtone is but indifferent large, the old way is preferable here to any other; but if it was large, then he had rather thruſt his fingers into the *Vagina*, and bring the ſtone as near the neck of the bladder as can be, and cut the membranes of the *Vagina* and bladder upon the ſtone; by this way is prevented the incontinency of urine, which always follows the extraction of great ſtones in women; he cut a woman by that way, from whom he extracted a ſtone weighing five ounces and a half, who recovered very well; neither does he approve cutting upon the gripe, as it is practiſed by ſome mountebanks; becauſe in that way the *Proſtates* are cut,

which deſtroys the parts of generation, and this he obſerved in all thoſe that have been cut by that method.

Parhelia *in* Suffolk; *by M.* Petto. Phil. Tranſ. N° 250. p. 107.

ON *Auguſt* 28th, 1698, about 8 o'clock in the morning, there was ſeen the appearance of three ſuns, which were brighteſt then, or a little after; about half an hour after eight, M. *Petto* himſelf ſaw it, when there was in the eaſt a dark watry cloud, and below it towards the middle was the true ſun, ſhining with ſuch ſtrong rays, that a perſon could not look upon him; on each ſide were the reflections, with the true ſun in the middle; in other parts, much of the firmament was of an azure, light blue colour; the circles M. *Petto* obſerved, were not of rain-bow colours, but white; there was alſo at the ſame time, but higher in the firmament towards the ſouth, and at a conſiderable diſtance from the other, the form of a half moon, but more than twice as big, with the horns turned upwards; within it was of a fiery red, and more like a rainbow colour; theſe all faded gradually, after having continued, from their firſt appearance, about two hours.

Sable Mice; *by Sir* P. Rycaut. Phil. Tranſ. N° 251. p. 110.

THE ſable mice, which were firſt obſerved about *Thorne* in *Lapland*, are near as large as a ſmall ſquirrel, their ſkin is ſtreaked and ſpotted with black and light-brown; they have two upper teeth, and as many under, which are very ſharp and pointed; they have feet like thoſe of ſquirrels, and are ſo fierce, that if a ſtick be held out at them, they will bite it, and hold it ſo faſt, that they may be ſwung about in the air; they are fat and thick, and without any tail; in their marches they keep in a correct line, generally from north-eaſt to ſouth-weſt, and each troop conſiſts of a great many thouſands, and its figure is for the moſt part a ſquare; they march by night, and in the twilight, and lie ſtill by day; the length of the lines in which they march is ſome ells, and parallel to each other; if they meet any thing that might ſtop their courſe, they do not go out of their lines, tho' it were a fire, a deep well, a torrent, lake, or moraſs, but without any heſitation they venture thro', and by that means many thouſands of them are deſtroyed; if they are met ſwimming over lakes, and forced out of their courſe, they preſently return into it again; when they are met in woods or fields and ſtopt, they ſet themſelves upon their hinder feet like a dog, and make a kind of barking or ſqueak-

ſqueaking noiſe, leaping up as high as a man's knee, defending their line as long as they can; and if at laſt they are forced out of it, they ſet up a cry reſembling *Biabb*, *Biabb*; they never come into any houſe, nor meddle with any thing that is food for man; if a houſe happen to be in their way, there they ſtop till they die, but thro' a ſtack of corn they will eat their way; when they march thro' a meadow, they endamage it much by eating the roots of the graſs, but if they encamp there by day, they quite ſpoil it, and make it look as if it were burnt, or ſtrewed with aſhes; the roots of the graſs, with rotten wood, and the inſects in it, are their chief, if not only food; theſe creatures are very fruitful, yet their breeding does not hinder their march, for ſome of them have been obſerved to carry a young one in their mouth, and another on their back.

It is reported that ſome poor *Laplanders* have eat ſeveral of them, and have found their fleſh taſt like ſquirrels; dogs and cats eat only the heads, and birds of prey eat only the heart; during the winter they lie under the ſnow, where they have breathing-holes a-top, as hares and other animals; the country people are very fond of theſe gueſts, as they foretel that there will follow a great plenty of game; as of fowls, ſquirrels, locats, foxes, &c. theſe mice are the ſame with thoſe called *Mures Norvegici*, *Norway* mice, deſcribed by *Olaus Wormius* in his *Muſæum*.

Plants *in* Jamaica; *by Dr.* Hans Sloane. Phil. Tranſ. N° 251. p. 113.

IN *Jamaica*, the neighbouring iſlands, and on the continent of *America*, there grow ſeveral ſorts of miſeltoe, by ſome they are called paraſitical plants and by others *Epidendra*, as growing on the trunks or arms of trees, after the manner of miſſeltoe and like it ſend roots, leaves, ſtalks, flowers and ſeed; from this reſemblance the Doctor gives the name of *Viſcum* to the ſeveral families of them.

There is one family he calls *Viſcum Cariophyloides*, from having its ſeed veſſel ſomewhat like that of clove-jelly flower, and a particular one of that family he calls *Viſcum Cariophyloides maximum* with a flower which has three leaves of a pale-clay colour and a ſeed full of fibres, that is commonly called in that iſland wild pine, the deſcription of which is as follows; a great many brown *Fibrillæ* encompaſs the arms, or take a firm hold of the bark in the trunk of the trees whereon they grow;

grow; not like miſſeltoe, which penetrates into the bark or wood to ſuck its nouriſhment, but only interwoven and matted together, to afford the plant a firm ſupport; hence ariſe ſeveral leaves on every ſide as Plate X. Fig. 12. *aaaa* after the manner of leeks, or *Ananas*, and hence it has the name of wild-pine or aloes, being folded or incloſed one within the other; each of them is two feet and a half long, three inches broad at bottom, and ending in a point; having very hollow or concave ſides within, it forms a very large reſervatory, ciſtern or baſon *b*, fit to contain a pretty deal of water; which in the rainy ſeaſons falls upon the uppermoſt parts of the ſpreading leaves that have channels in them to convey it down to the ciſtern, where it is kept, as in a bottle; the leaves, after they are ſwelled out like a bulbous root to form the bottle, bend inwards or come again cloſe to the ſtalk, whereby they hinder the evaporation of the water by the heat of the ſun; they are of a light green colour below, and like leeks above, from the middle of theſe ariſes a round, ſmooth, ſtraight, freſh green-coloured ſtalk, three or four feet long *c*, that has ſeveral branches; when wounded, it yields a clear mucilaginous gum; the flowers come out here and there on the branches; they conſiſt of three long, yellowiſh, white or herbaceous leaves, and ſome purple ended *Stamina*, that ſtand in a long *Calyx* or *Tubulus* made up of three green viſcid leaves with purple edges, to which is a long triangular *Capſula d* of a greeniſh-brown colour, being ſomewhat like thoſe of the *Cariophylli*, and having under it three ſhort capſular leaves and within ſeveral long pappous ſeeds; the ſeed itſelf being oblong, pyramidal and very ſmall, having very ſoft hairs, down, or *Tomentum*, much longer in proportion to the ſeed, than any the Dr. ever ſaw, being as long as the pod or *Capſula*: It grows on the arms of trees every where in the woods, as alſo on the bark of their trunks, eſpecially when they begin to decay, the bark then receiving the ſeed, and yielding more eaſily to the fibrils of the roots of this plant, which in ſome time diſſolves it and ruins the whole trunk.

The contrivance of nature in this vegetable is very ſurpriſing; the ſeed having ſeveral long threads of *Tomentum*, not only that it may be carried every where by the wind, as the pappous and tomentuous ſeeds of *Hieracium*, *Lyſimachia*, &c. are, but alſo that when it is driven thro' the boughs it may be held faſt by thoſe threads, and ſo ſtick to the arms and extended part of the bark of trees; as ſoon as it ſprouts or germinates, tho'

tho' it be on the under parts of a bough or trunk of a tree, its leaves and ſtalk riſe perpendicularly or ſtraight up; becauſe if it had any other poſition, the ciſtern before mentioned made of the hollow leaves, by which it is chiefly nouriſhed not having any communication with the tree could hold no water, which is neceſſary for the nouriſhment and life of the plant: In the mountainous as well as dry low lands, this reſervatory is not only neceſſary and ſufficient for the plant itſelf, but is likewiſe very uſeful to men, birds and all ſorts of inſects, to which they come in great numbers when water is ſcarce, and ſeldom go away without refreſhment.

There are ſome contrivances in plants growing in *Europe*, which in ſome particulars come near thoſe of this kind of vegetables; the *Virga paſtoris* or wild teaſel, and moſt perfoliated plants has its leaves incloſing its ſtalk and ſo ſet by pairs oppoſite to each other, and joined by their baſes, form a cavity fit to contain ſome water, which tho' open, yet undoubtedly contributes to the perfecting the plant; ſeveral *Fuci* have been diſcovered to have ſeeds, which when ripe break out of their places, and by means of a glewy juice faſten themſelves to ſtones or other ſubſtances at the bottom of the ſea, where they are to grow; the common *Viſcum* has ſuch a glewy ſubſtance, probably for faſtening its ſeeds to the bark of trees; ſmall moſſes, heretofore thought to have no ſeed, are now known to have great plenty of it, and that ſo ſmall, that the Doctor ſaw it riſe up from the ripe head in form of ſmoak; which without queſtion is deſigned that the ſeed may be carried by the wind to walls, trees, or other fit matrixes for its vegetation; there is a *Fungus* called by *Cluſius*, *Fungus minimus anonymus*, and by Dr. *Merret Campaniformis niger*, *multa ſemina plana in ſe continens*, that when ripe opens in the rain, and filling a cup, wherein lies its ſeeds, they are waſhed out on every way, in order no doubt to propagate its kind.

There are many families of plants with pappous or tomentous ſeeds, as *Dandelion*'s, *Erigerum*'s, *Lyſimachia*'s, *Clematis*'s, *Anemone*'s, &c. which when ripe, their ſeeds are by means of their feathers or wings ſcattered by the wind to the adjacent parts; this is ſo effectual a way that the *After Canadenſis annuus non deſcriptus*, *Prunyer* or *Conyza*, *annua alba acris Moris*, which came at firſt from *Canada*, is now become a wild plant in many places of *Europe*, where it never was obſerved to grow, and far from the gardens where it was firſt planted, the ſeed having been carried thither by its wings, and the Doctor had

had ſeen it in ſome parts of *France*, a great many leagues from ſuch places: There are likewiſe many plants with ſeed-veſſels ſo contrived, that when ripe, with a ſpring and ſometimes a briſk noiſe, they throw off their ſeeds ſeveral ways to a conſiderable diſtance; moſt plants that have pods, as furze, *&c.* thoſe called *Noli me tangere*, *Cucummis Aſininus*, cranes-bill and ſeveral others have this mechaniſm in order to ſow themſelves; amongſt thoſe that have this property, none is more ſurpriſing than one in *Jamaica* called ſpirit-weed; that the veſſel containing its ſeed, when ripe, upon the leaſt touch of whatever is wet, does open itſelf inſtantly, and with a noiſe throws its ſeed ſeveral ways to a conſiderable diſtance; the deſign of nature being, it is likely, to keep the ſeed in its ſeed-veſſel, the beſt preſerver of it from injuries, till the rainy ſeaſon comes on which is proper for ſowing; *Lychni*'s, poppies, *Antirhinnum*'s, and ſeveral others have their ſeeds in heads, which when ripe are open a-top; and by the winds, and with the help of their partitions are ſcattered and directed to all quarters; theſe and a great many more inſtances, very obvious and wonderful, tho' not taken notice of, ſhew the great endeavours of nature to perfect the *individuum* and propagate the kind; which for that reaſon, Dr. *Sloane* was apt to think, are all without the loſs of one ſpecies, preſerved to us from the creation to this day.

A Fœtus *lying without the* Uterus *in the Belly*; *by Dr.* Fern. Phil. Tranſ. N° 251. p. 121.

A Goldſmith's wife, near nine months gone with her 5th child, was received into the *Hotel Dieu*, being then about 34 years of age, and of a tender conſtitution; the midwife, who examined her body, found a conſiderable tumor on the right ſide near the navel, which very much reſembled a child's head, her belly below that place bearing no proportion to that above, or to the time of her pregnancy; on the left ſide there was nothing ſingular; the patient told her midwife, that for the firſt ſix weeks after her being with child, ſhe had great and continual pains, which ſhot towards the navel and terminated there; and theſe laſted 'till the third month; that from thence to the ſixth ſhe had frequent convulſions, apoplectic fits and terrible *Syncope*'s, ſo that thoſe about her deſpaired of her life; that from the ſixth to the eighth month ſhe had enjoyed a much better ſtate of health, which in ſome meaſure had ſtrengthned both her and her infant, that the pains ſhe had endured ſince that time ſeemed to be ſo many alternate throws, probably proceeding from the repeated

repeated ſtrokes of the child's head in that place where the integuments were ſo thin, by reaſon of their great extenſion, that the hardneſs of the *Cranium* could plainly be felt thro' them: In this condition the patient was, when received into the hoſpital; till her affliction encreaſing, ſhe could not lie upon her ſide or back, being forced to ſit in a chair, or kneel in bed, with her head reſting on her breaſt; from theſe ſtrange and unaccountable ſymptoms, the phyſician and maſter chirurgeon of the houſe, thought it was beſt to leave the work to nature, and prepare the woman for her labour by opening a vein in her foot; the evacuation was ordered to be ſmall, in which, regard was had to the weakneſs of the patient, and the delicacy of her conſtitution; however, after this time the child made no efforts, the tumour ſubſided, and there remained only an hydropic indiſpoſition, which might be perceived by the fluctuation and a great quantity of water came away, for ſeveral days, from the orifice of the vein; inſomuch, that ſhe, who ſeemed to have her lower belly and thighs extremely diſtended, was very much waſted before her death.

After her deceaſe, her body was opened by M. *Jouey*, and upon the firſt inciſion thro' the integuments, there came away two or three pints (*Paris* meaſure) of water and blood, and there appeared the head of a child naked; and when the parts were all laid open, there was found an entire female *Fœtus*, contained in a ſort of cover or bag, which at once ſerved it both for a womb and membranes; M. *Jouey* took the child with the umbilical ſtring out of the mother's belly, tracing the ſtring to the *Placenta*, into which it was inſerted; this laſt appeared like a great round lump of fleſh, and adhered ſo firmly to the *Meſentery* and *Colon* on the left ſide, that it could not be ſeparated from them without ſome difficulty; on one ſide of this lump was a leſſer, about the ſize of a kidney, which principally adhered to the *Meſentery*, and received ſeveral branches of the ſtring into it; the larger lump was round, and the greateſt part of it adhered to the bag, or caſe, which contains the child; this caſe, or bag, was corrupted and mortified in part, which probably might proceed from the frequent ſtrokes of the infant's head; it ſprung from the edges of the *Tubæ*, or *Fimbria* of the right ovary, which was more entire than the left, and proceeded obliquely to the left ſide, terminating at the bottom of the *Pelvis*; in its deſcent it ſent out a ſmall portion between the womb and *Rectum*; this bag, by compreſſing the parts, had gained a conſiderable ſpace in the above-mentioned cavity, in ſuch manner that a great part of

the child's body was lodged at the bottom of it in a bended posture, with the head projected forwards, which formed the prominence near the navel; this bag seemed to be nothing else but an elongation and distension of the *Tuba*, and an expansion or production of the broad ligament on the right side, which was evident from its continuity to those parts, and the distribution of the spermatic vessels, which were larger than usual, and passed from the extremity of the *Tuba* to the larger lump: The womb was entire, and in its natural state, except that it was something larger than ordinary, being about the size of that of a woman 10 or 12 days after her delivery, and there were no signs that the child had been lodged therein.

M. *Jouey* having observed this, called for several eminent physicians and chirurgeons, and the womb being carefully dissected, it was unanimously agreed, that the *Fœtus* had never been therein; it being in the same state, as in women that are not with child, except the small dilatation of its bulk, which might arise from a compression of the vessels, and interception of the refluent blood, by the unnatural position of the *Fœtus*: In thrusting a long and slender probe thro' the right horn of the *Uterus*, it easily passed into the *Tuba* of the same side for three fingers breadth, in length two, but could not be thrust farther, by reason of the constriction of the *Tuba* in that part; the capacity of the *Tuba* could not be distinguished; its *Parietes*, by their coalition with the *Chorion* and *Amnion* of the child, forming the bag, in which the child was included, which extended from the tube on the right side to that on the left, was agglutinated to the *Viscera* in the lower belly, to the *Rectum*, and back part of the womb, as appeared by some fragments remaining on those parts after the separation.

Parhelia *observed at* Canterbury; *by Mr.* Steph. Gray. Phil. Transf. N° 251. p. 128.

February 26th, 169$\frac{8}{9}$, about half an hour after three in the afternoon, from a window that faced south-east, Mr. *Gray* saw, not far from the south to the westward, an appearance of somewhat not unlike the sun, when seen thro' a cloud, *viz.* with its periphery not exactly defined; from which it likewise differed, in that one half of it was coloured of a deep red and yellow, the other white; Mr. *Gray* going immediately into the garden, saw an appearance exactly like the former, but on the opposite side of the sun; the distance of this was 23° from the sun to the westward; but before he could take the distance of the eastern one it vanish-

vaniſhed, but ſoon after re-appearing, he manifeſtly perceived that they were both ſituated in the extremities of a ſemi-circle, whoſe centre was the ſun, paſſing betwixt it and the *Zenith*; this appearance continued about half an hour.

A Child *born without a* Brain; *by M.* Buſſiere. Phil. Tranſ. N° 251. p. 141.

A *French* woman, living at *Dung-hill*, of a good complexion, and in perfect health during all the time of her being with child, was brought to bed of a boy; he was tall, well ſhaped, and very ſound; and tho' it be uncertain whether he was born alive, yet the mother aſſured M. *Buſſiere*, that ſhe felt him ſtirring an hour before, and indeed the good condition of his body ſufficiently proved that he was alive; the ſcull was unequal, and the ſkin thereof, tho' full of hair, was a little redder than the reſt of the body; the coronal bone being laid upon the ſphenoid, made the eyes look, as if they had been placed in the top of the forehead; the ſquamous part of the temporal bones was wanting, and the *Os Petroſum* the only bone that was in its natural place, and in which were the organs of hearing in very good order; there was no parietal bones, nor any thing equivalent thereto; of the occipital bone there was only the baſis that joins to the ſphenoid, in the middle whereof was the great hole, thro' which the *Medulla oblongata* commonly paſſes; all the upper part of this bone being wanting, without any mark of having been either corroded or corrupted, and its edges were very ſmooth; all the upper part of the bones of the ſcull being wanting, the ſkin had no other ſupport than its baſis, which was the reaſon why the top of the head was very unequal and rough; there was no brain to be found, nor any mark in the whole extent of the ſcull that there had been any, there being no ſpace left between the baſis of the ſcull and the ſkin to contain it; there was no *dura Mater* neither, the bones being covered only with a very thin membrane; neither did the carotid or vertebral arteries penetrate the ſcull, but by ſmall twigs ſpread themſelves in that thin membrane; the beginning of the ſpinal marrow was under the fourth *Vertebra*, like a ſmall ſtump wrapped up in the *dura Mater*; the marrow was very ſound, and of the uſual bigneſs, and all the nerves, which iſſued from it, were in their natural order; the eyes were well ſhaped, and all the parts belonging to them in their natural ſituation; but all the nerves terminated in thoſe holes of the ſcull, thro' which they commonly paſs; they reached no further, nor had any communication with

any other; the tongue was very freſh, and doubtleſs had performed the deglutition to make the child ſwallow the *Colliquamentum*, of which there was a good quantity in the ſtomach; the *Larynx*, and all the parts of the throat were, as the reſt of the body, in a good condition.

A Dropſy *in one of the Ovaries of a Woman; by Dr.* Hans Sloane. Phil. Tranſ. N° 252. p. 150.

MRS. *Brown*, aged about 29, of a ſanguine complexion, had been married about four years, in which time ſhe had had one child; after that, her belly ſwelling, ſhe thought ſhe was with child again; ſhe had often violent hyſteric fits, ſomething like thoſe of an epilepſy, during which, ſhe lay ſometimes without ſenſe or motion, at other times with ſcreaming, and idle talk; theſe by proper remedies, were removed at ſeveral times with difficulty; when ſhe was ſix months, as ſhe thought, gone with child, ſhe began to have ſome doubt whether it were ſo or not, becauſe ſhe had her *Menſes* very regularly; Dr. *Sloane* was of opinion ſhe was not with child, and would have treated her with ſteel and chalybeates of water, as bodies hydropically diſpoſed require; but her fancying ſhe felt the child ſtir, put a ſtop to that courſe; ſhe delayed the propoſed method for three or four months beyond the ninth, thinking ſhe had reckoned wrong; but at laſt ſhe was perſuaded to take medicines, and ſhe underwent a ſtrict courſe as is uſual in hydropical caſes; her legs did not ſwell nor pit, her belly was unequal and the ſwelling more on the right ſide, ſo that the navel was thruſt over to the left ſide; ſhe had alſo diſcutient plaiſters applied to her belly, but all in vain excepting that with much anxiety, gripes and trouble, ſo much water was evacuated, as to bring down her belly three or four inches; at laſt ſhe ſubmitted to a tapping, which was performed at ſeveral times, and diſcharged great quantities, firſt of a limpid thick *Serum*, like whites of eggs, inſipid and coagulable by heat into the like ſubſtance; and what came afterwards was of the colour and conſiſtence of thin honey, and coagulated upon evaporation; in ſome time after ſhe fell into a fever, with a great thruſh, hickups, and in about nine days time ſhe died.

Out of her body, when diſſected, there was diſcharged ſome buckets of the ſame watry ſubſtance with what came by tapping; part of it was floating in the abdomen, but far the greater part was voided out of large and thick bags, ſome of which were as large as the ſtomach, others were ſmaller, many of them were rotted to pieces, and all of them in the right ovary or teſticle; the

the *Uterus*, *Tuba Fallopiana* and every thing elſe was found, except the *Omentum*, which was quite conſumed; what was very ſtrange was, that ſeveral bags of the larger ſize in this ovary contained others ſmaller within them, and the larger were filled with a liquor like honey, and the ſmaller with a ſubſtance like whites of eggs; here and there were impoſthumes, which were but ſmall and filled with yellow matter; the gall-bladder was full of ſeveral triangular yellow ſtones; ſhe was very lean all over her body, her legs never ſwelled nor pitted, and there was no noiſe of water on her ſtirring in bed, till ſome little time before tapping, when ſhe fell into ſo great an *Orthopnœa*, that ſhe could not breathe unleſs in an erect poſture.

The great Tendon *above the* Heel, *after an entire Diviſion of it ſtitched and cured; by Mr.* Will. Cowper. Phil. Tranſ. N° 252. p. 153.

MR. *Cowper* being called to *Tho. Wheatley* a carpenter, aged 30 years, who had totally divided the great tendon of the *Muſculi Gaſterocnemii* of the left leg, about three fingers breadth above the *Os calcis*; he found the upper part of the tendon withdrawn from the lower; two inches at leaſt.

The applications being prepared and two or three large needles with ſtrong ſilk in them well waxed, he was obliged to divide the external teguments *a*, *b* Fig. 13. Plate X. to come at the ends of the divided tendon A, B; this done, he paſſed the firſt needle C thro' the body of the tendon A, about half an inch above its divided extremity; the ſecond needle D was thruſt thro' this upper part of the tendon, a little under the former, leſt the two threads, ſhould meet each other at their croſſing in the middle of the tendon; afterwards both theſe needles were paſſed thro' the lower part of the divided tendon B; the foot being held extended, the two ends of the tendon were applied to each other by the aſſiſtance of the ligatures C, D, which were ſo tied as to keep the divided parts cloſe together, whilſt the foot remained in this poſture; after the four ends of theſe ligatures were cut off, Mr. *Cowper* found it was neceſſary to bring the ſides of the divided ſkin near each other, with one ſingle ſtitch, a little above the future of the tendon; this done, a pledget of lint dipt in balſam of turpentine was laid on the wounds, and another large pledget of flax, armed with *Linimentum é gummi elemi* over it; after the application of common bandages, bolſters, *&c.* he found it neceſſary to place a thick piece of paſtboard of a convenient arched figure on the foreparts of the foot and leg, to keep the part

part inflected, and to prevent any motion of it, which might break out the ſtitches in the tendon; the patient complained very much in paſſing the needles thro' the upper part of the divided tendon, tho' its middle and internal part at the diviſion was ſcarcely ſenſible; he had no pain in paſſing the needle thro' the lower part of the tendon; afterwards 14 ounces of blood was taken from his arm, and in ſix hours Mr. *Cowper* found his pulſe ſomewhat quicker than before; then he took an ounce of ſyrup *é Meconio*, and next morning he was in no bad condition, having had ſome ſleep the night before, but was often waked with twitchings in the calf of the wounded leg; the third day after the operation, Mr. *Cowper* dreſſed the wound with the ſame applications as before, only uſing a fomentation made of a decoction of wormwood, ſage, roſemary, bay-leaves, *&c.* on the fourth day after the operation he found the applications on the wound very wet with a ſerous humour, commonly called a gleet; on the ſixth day the matter became ſomewhat thicker, and the ſkin being a little diſtended about the wound, he was obliged to divide the laſt mentioned ſtitch in order to admit a free diſcharge of the *Pus*, which on the two ſucceeding days became much thicker than before, and the gleet was conſequently leſſened.

About this time the two ends of the tendon were not a little dilated, and a white ſlough appeared towards the upper part of the wound, on which, inſtead of the balſam of turpentine, he applied tincture of myrrh; in ſome days after, this ſlough came off, and the two ends of the tendon were covered over with a fungous fleſh, by which Mr. *Cowper* was aſſured that its blood-veſſels and nutritive tubes, were not compreſſed by the two firſt ligatures; afterwards he made uſe of drier applications than before, ſometimes uſing lint only, and at other times the powder of turpentine; about 10 days after the operation, Mr. *Cowper* found one of the two ligatures in the tendon hanging looſe, which he divided and drew out; and two or three days after, the other ligature alſo was looſe, which he in like manner removed; the part being all this while kept inflected by the paſt-board abovementioned: Mr. *Cowper* was often obliged to apply eſcarotics to leſſen the *Fungus* on the tendon; in leſs than 30 days after the operation the patient went abroad very lamely, and not many days after he walked round St. *James*'s park; within 8 weeks after the operation he walked from *Witch-ſtreet* without *Temple Bar*, to *Greenwich*, and returned in a few hours; he entirely recovered all the motions of his foot and ſhewed very little lameneſs in walking, not being in the leaſt incommoded at his trade.

It

It is a common opinion that ſtitching divided tendons is hazardous, if not impracticable; but an inſtance in the tendon of a horſe's leg convinced Mr. *Cowper* that tendons as well as bones and other parts would unite, tho' they were quite divided, in caſe the neighbouring parts remained entire, and that their two extremities could be artificially applied to each other, without compreſſing all or the greateſt part of their blood-veſſels: This diſtribution of the blood-veſſels is expreſſed in the annexed Fig. 14. Plate X. where one trunk A A, with its branches *a a* to the fibril of the tendon B B is repreſented, whether it was a vein or an artery he could not diſcover in that ſubject; but in all probability, both thoſe veſſels have the like diſpoſition in ſuch large tendons. Mr. *Cowper* is inclined to think that the like diſtribution of blood-veſſels is not to be found in the tendon which was divided in this preſent inſtance; but that its blood-veſſels paſs into it and return again at its internal ſide, next the muſcles of the toes and *Tarſus*, which ought to be taken notice of by the operator in the like caſe; as alſo that he ſhould not free it of its fat and membranes contiguous to thoſe muſcles, leſt its communication with the blood-veſſels be deſtroyed.

The Operation of a Bliſter, *in the Cure of a* Fever; *by Dr.* William Cockburn. Phil. Tranſ. N° 252. p. 161.

IN order to give a reaſonable account how a bliſtering plaiſter, the great ingredient whereof is *Cantharides* may cure a fever and its moſt terrible ſymptom a *Delirium*, and that in a few hours; the Doctor firſt employed microſcopes to view the fly, and its powder, if he could diſcover any ſharp inſtrument in theſe animals but could meet with no ſuch thing in the fly, and the powder appeared to view like a dark cloud; he then put half a pound of *Cantharides* into a retort, and with a ſmall ſand-heat and in a very ſhort time, there came over vaſt quantities of bodies ſo very ſmall, that he was not able to diſcern their ſhape; and tho' he proceeded in the uſual way on ſuch like occaſions, the whole operation was performed very ſoon; that very little ſalt ſtuck to the neck of the retort, and the volatile ſalt ſhot into beautiful cryſtals in the receiver; and of eight ounces of *Cantharides*, there were only two ounces and five drachms left as a *Caput Mortuum* in the retort; when the liquor came to be purified, the ſmalleſt heat brought over ſuddenly oil, ſalt, and ſpirit, which could not be ſeparated, but by repeated operations with brick-duſt, he mixed the ſpirit with ſalt of wormwood, ſpirit of harts-horn and *Sal Armoniac*, but it did not ferment; then he wrought it

it over upon ſpirit of vitriol, where it fermented very ſtrongly; and yet the fever is ſaid to intermit; theſe diſeaſes are perfectly well diſcovered by the quickneſs of the pulſe, which quickneſs is owing to the faultineſs of the blood, either in quantity, quality or its motion; neither can it offend either in quantity or quality, but it affects its motion; hence he ſuppoſes that a fever is an univerſal heightened circulation of the blood, and that a *Delirium*, that is, that inconnected, incoherent and ridiculous imagination, and method of expreſſing ourſelves in a fever, is entirely the effect of this greater motion, which is diſcovered by a quick pulſe.

Theſe things being ſuppoſed, the queſtion may be ſtated thus; how wounding by *Cantharides* makes our pulſe not ſo quick, and conſequently our blood to have a more ſlow and natural motion? That this great effect does not proceed from the pain of a bliſter, is evident, becauſe pain very often brings on a fever; nor from a peculiar ſort of fermentation of the particles of *Cantharides* with the blood, becauſe there is no ſuch thing as a chemical fermentation in our blood; and the quantity of *Lympha*, that is thereby ſeparated from the blood, is acknowledged by moſt phyſicians to be too weak a cauſe for ſo great an effect; the Doctor therefore proceeds to enquire after a better ſolution of this aſtoniſhing phænomenon, thus; the pulſe is no other than the ſide of an artery diſtended by a determinate quantity of blood, derived thro' its cavity by a certain motion, every time the heart is contracted, and that touches and beats up the finger; a pulſe is more frequent, not ſo much that it beats oftener than any other perſon's, but that it beats quicker in the ſame perſon when he is ſaid to have a fever, than before, when he was reputed to be in perfect health, and there is no pulſe, but when the heart is contracted; and the heart being a muſcle, and contracted at every pulſe, is not only either the chief or ſole cauſe that determines and ſtretches the ſides of the arteries, and makes a pulſe, or a very extraordinary meaſure of ſuch diſtenſions; but it has the greateſt ſhare in propelling the blood round the whole body, in reſpect of the help of the arteries, which they are ſuppoſed to give by their reſtitution after their extraordinary diſtenſion; be it how it will, both their actions are by contraction, which was never ſuppoſed to be performed, but by an influx of ſpirits into the fibres of the muſcles ſo contracted; ſo that now the queſtion changes thus; how wounding by *Cantharides* makes the contraction of the heart weaker? The contraction of muſcles and conſequently of the heart, being by the ſpirits that flow into them, therefore what-

ſoever weakens the contraction of any muſcle, ſuppoſe the heart, muſt either be ſuch as can hinder the ſeparation of theſe ſpirits, or intercept them in their channel of conveyance to that muſcle, after they are ſeparated; the ſpirits, by anatomical experiments, are known to be ſeparated from the blood in the brain; now whatſoever hinders the ſeparation of the ſpirits from the blood, muſt either hinder that rarefaction of the blood, which is cauſed by its being broken into ſuch ſmall parts, as conſtitute them ſpirits in their proper place, or the blood to be of that fineneſs that is neceſſary for it to be perſpired; that is, a body, that affects the blood, ſo as not to ſeparate ſpirits, muſt be of ſuch a nature, as to make its parts more compact in their contact, to have their contact with a greater *Niſus*, and conſequently to have its parts leſs ſeparable; the next way is by affecting its motion, which is by diſcharging great quantities out of the blood; by theſe means the quantity of blood being leſſened, it yields fewer ſpirits when it is divided, and is not ſo capable of being comminuted, becauſe the parts of the blood do not preſs ſo much one upon the other, in the whole courſe and time of circulation; or thirdly, by ſome means that affect the parts that tranſmit theſe ſpirits, ſo that now either no ſpirits can be ſeparated, or in a ſmaller quantity; if we apply the wounding by *Cantharides*, or its effect to all theſe ways, *viz.* by ſeparating the *Lympha*, by evacuation or leſſening the rarefaction of the blood, they will be found uncapable of ſolving all the *Phænomena*, and therefore the only way left us wherein a bliſter can produce its effect, is, by wounding that channel that carries thoſe ſpirits which contract the heart, give a quick pulſe and a fever, with all its attendants, as deliriums, *&c.* If this ſuppoſition be allowed of, no doubt but that any, the leaſt quantity of animal ſpirits, let out by ſuch wounds will in a very little time proportionably weaken the heart's contraction, and give a ſlower pulſe, which is all that is wanted; and what is more, this ſlower contraction, which is known by the ſlower pulſe, determines the whole circulating blood with leſs force, ſo that the parts of blood do not comminute themſelves ſo much, as when the motion was more rapid, and by conſequence there is not ſuch a diſpoſition for ſeparating the ſmall particles in the brain, that they may afterwards be derived thro' the nerves into the heart; but moreover, the leſſer motion continuing for ſome little time, in a velocity ſomething like our natural motion, all the ſecretions performed in ſuch degrees of velocity will again begin to be perform'd as before: But how to apply a bliſter that may wound the conveying nerves, is

the only queſtion that remains; to do this we muſt remember, that the 8th pair of nerves which ſerves for the heart's contraction, has its riſe from the ſides of the *Medulla oblongata* behind the *Proceſſus annularis*, by ſeveral threads which join together, and go out by the ſame hole, that the *Sinus laterales* diſcharge themſelves into the jugulars; and ſince the union by the *Atlas* is not ſo firm and compact as in the other *Vertebræ*, it is evident that there is no extraordinary hindrance, why ſome of theſe wounding particles may not come at that nerve, ſince either it, or conſiderable branches thereof run ſuperficially enough upon the neck.

From all this may be deduced theſe following corollaries: 1. That the operation of a bliſter is great and ſudden. 2. That the wounding of this nerve or a branch of it, is ſo abſolutely neceſſary for curing a *Delirium* and a fever, that whatſoever miſchief the applying of vaſt numbers of bliſters over all the body may do, yet the main end is neglected, if you forget a large one on the upper part of the nape of the neck. 3. That if there is no veſication after the laying on a ſtrong plaiſter, it neceſſarily cauſes a new and prodigious hardneſs in the ſkin and veſſels, and a thickening of the blood for a further total ſtoppage.

The Nature and Qualities of Silk; *by Mr.* Will. Aglionby. Phil. Tranſ. N° 252. p. 183.

SILK, which is the ſpittle of a worm, hath either its good or bad qualities from the nouriſhment the worm receives from a good or bad leaf; when the ſpring proves agreeable, the worm feeding on a good and tender leaf, free from the injuries of an unkind ſeaſon, which ſometimes ſpoils the leaf by giving it a rough, groſs and heavy nature, then may be expected a profitable harveſt; about *Midſummer* or St. *John's-tide*, they begin in *Piedmont* to draw the ſilk, to ſee what it yields, and judge of its increaſe and ſcarcity, as well as of its goodneſs and perfections, which are, that it proves clean, light and ſtrong. The goodneſs of ſilk is diſtinguiſhed by its lightneſs as the moſt eſſential quality; it is to be noted that the *Organcine* is ſuperfine, it being the beſt ſort; that the two threads are equal in fineneſs, that is to ſay, both alike in ſmoothneſs, thickneſs and length, for the thread of the firſt twiſt; for the ſecond it matters not whether the ſingle thread be ſtrong before the two are join'd, unleſs to ſee whether the firſt twiſt prove well; it is neceſſary the ſilk be clean; the ſtraw-colour is commonly the lighteſt, and the white the heavieſt of all; it is likewiſe convenient that the

ſkeans

ſkeans be even and all equal, which ſhews they were wrought together; otherwiſe they cannot be equally drawn out and ſpun; it is requiſite to take a ſkean out of the parcels to make an eſſay.

To eſtimate the ſilk by eſſay, fix the eſſay upon the eighth of a *Portee-hand* of ſilk of 110 ells of *Lyons* in length, and ſee what it makes of ells by the eighth part; the ſkean of 80 threads muſt be multiplied by 110, the length of the ells, from which product muſt be deducted one eighth, which is the eighth part of a *Portee*; this *Portee* muſt be equally divided on two bobbins, then fixing the two bobbins on the beam, and from thence paſſing it thro' the hourdiſſoir, cut off the ſilk and weigh it, and multiplying the weight by 8, it will weigh juſt as much as a *Portee* of 110 ells of *Lyons*, which is the general rule of calculating, when they draw the ſilk out; the *Portee* of lighteſt ſilk in *Piedmont* weighs near 24 pennyweight to 25 and 26, others 27 and 28, which weight may be diſpenſed with, provided the other qualities be as good, *viz.* well-wrought, even, fine and clean.

A Diſeaſe cauſed by ſwallowing Stones; *by Sir* Charles Holt; *with Remarks thereon by Dr.* Sloane. Phil. Tranſ. N° 253. p. 190.

ONE *Thomas Gobſill*, a lean man aged about 26 or 27 years, being for 3 years extremely tortured with wind, was adviſed to ſwallow round, white pebbles, which he did as often as the fit returned, and the ſtones paſſing eaſily through him, he thereby found great relief; but ſome months after being ſeized with a violent fit, he ſwallowed as uſually about 9 ſtones, which not paſſing, he repeated the doſe, till he had taken above 200; theſe ſtones were lodged in his body above two years and a half, when he firſt came to Sir *Charles*, and then he complained that his appetite was gone, that he could digeſt nothing, but threw up every thing he eat; upon examining his belly, Sir *Charles* found the ſtones lay almoſt as low as the *Oſ pubis*, and thruſting his fingers juſt above that bone, ſo that the lower part of the *Abdomen* might lie on his hand, he could with the motion thereof ſhake and make them rattle, as if they had been in a bag; hereupon he cauſed a ladder to be ſet againſt a wall and hung him up by the hams, with his head downwards; when he was in this poſture he told Sir *Charles* the ſtones were got up to his ſtomach; but being ſet down upon his feet, in a very little

time, the ſtones were plainly heard to drop down one after another.

When his body was bound, he vomited all he eat and drank, to prevent which, he commonly kept it open with whey; as he lay a-bed, the ſtones would ſometimes get up, as the patient expreſſed it, almoſt to his heart, and give him great uneaſineſs; and at ſuch times he was obliged to get up upon his knees, or ſtand upright, and then he could hear them drop, and he always reckoned above 100; he was ſo diſabled by theſe ſtones, that he could not work but with pain, and then he felt the ſame at night, and next day a great ſoreneſs in the bottom of his belly, and voided large quantities of blood by ſtool; he had been under the hands of ſeveral Quacks, ſome had vomited him with *Stibium*, and purged him; others purged and glyſtered him, but all the medicines they made uſe of, could never bring one ſtone from him.

Dr. *Sloane* obſerves, that ſome people, who ſee birds languiſh, unleſs they ſwallow gravel or ſmall ſtones, take up an opinion, that the ſwallowing of ſtones helps the ſtomach to digeſt their food; but the Doctor always oppoſed this practice, becauſe, tho' the ſtomachs or gizzards of birds (having no teeth to grind their food) are made very ſtrong, muſcular, and defended in the inſide with a coat, by the help of which, and theſe ſtones, their food is ground; yet the ſtomachs of men being very different, it is not reaſonable to think theſe ſhould be of any uſe to them: The Doctor knew one Mr. *Kingsmill*, who for ſeveral years uſed to ſwallow nine ſtones at a time, and that once every day, without any injury; they were near as large as walnuts, roundiſh and ſmooth, and he found they always paſſed; but at laſt he died ſuddenly.

Some Thoughts and Experiments concerning Vegetation; *by Dr.* J. Woodward. Phil. Tranſ. N° 253. p. 193.

THE ancients generally have aſcribed to earth the production of animals, vegetables, and all other bodies; but ſeveral of the moderns, and ſome of very great note too, have given their ſuffrage in behalf of water; my Lord *Bacon* being of opinion, that *for nouriſhment of vegetables the water is almoſt all in all, and that the earth doth but keep the plant upright, and ſave it from over heat and over cold*; others are more expreſs, and aſſert that water is the only principle, or ingredient in all natural things; they ſuppoſe, that by a proceſs of nature, which cannot be

be accounted for, water is tranſmuted into ſtones, &c. *Helmont* particularly, and his followers, are very poſitive in this, and offer ſome experiments to render it credible; and Mr. *Boyle* diſcovers a great propenſity to the ſame opinion; the experiments they inſiſt upon are chiefly two; the firſt is, that mint and ſeveral other plants thrive very much in water; the other is this, take a certain quantity of earth, and bake it in an oven, then weigh it, and put it into an earthen pot, and having water'd it well, chuſe ſome proper plant, which, after being firſt carefully weighed, ſet therein, and let it grow, continuing to water it for ſome time, till it is much advanced in bulk; then take it up, and tho' the ſize and weight of the plant be much greater than when firſt ſet, yet upon baking the earth, and weighing it as at firſt, you will find it little or not at all diminiſh'd in weight, and hence they conclude that it is not the earth, but the water that nouriſhes, and is turned into the ſubſtance of the plant.

Dr. *Woodward* could not ſee how this laſt experiment could ever be made in all its circumſtances with that nicety and juſtneſs that is requiſite; however, nothing, like what they would infer can poſſibly be concluded from it; unleſs they ſuppoſe water, which they ſo plentifully beſtow upon the plant in this experiment, to be pure, homogeneous, and not charged with any terreſtrial mixture, for if it were, the plant after all might owe its growth and increaſe intirely thereto: Some waters are ſo very clear and tranſparent, that one would not eaſily ſuſpect there was any terreſtrial particles latent therein, yet that is far ſhort of a proof that in reality there is none; for water may be highly ſaturated with ſuch particles, tho' the naked eye cannot preſently diſcern them: Silver, tho' an opake and very denſe body, yet if pure and abſolutely refined, diſſolved in ſpirits of nitre, or *Aqua-fortis*, that is rectified and perfectly fine, it does not render the *Menſtruum* leſs pellucid than before: But after all, the Doctor could never meet with any water, however freſh, and newly taken out of the ſpring, that did not exhibit even to the naked eye, great numbers of exceeding ſmall terreſtrial particles, diſſeminated thro' all its parts; thicker and craſſer water exhibits them ſtill in greater plenty: Theſe particles are of two general kinds; the one a vegetable terreſtrial matter, conſiſting of very different corpuſcles, ſome of which are proper for the formation and increment of one ſort of plants, and ſome for others; again, ſome for the nouriſhment of one part of the ſame plant, and ſome for another part: The other kind of particles, ſuſtained in water, are of a mineral nature; in ſome ſprings we find common ſalt, in others vitriol,

vitriol, allum, nitre, ſpar, oker, *&c.* nay, frequently ſeveral of theſe or other minerals, are all in the ſame ſpring: For further ſatisfaction herein, put water into a clear glaſs phial, ſtopping it cloſe to keep duſt and other extraneous matter out, and let it ſtand without ſtirring for ſome days, you will then find a conſiderable quantity of terreſtrial particles in the water, however pure and free it might appear when firſt put into the phial; and in a very ſhort time you may obſerve the corpuſcles, that were, whilſt the water was agitated, ſeparate and hardly viſible, by degrees, as it is more at reſt, aſſemble and combine together, by that means forming ſomewhat larger and more conſpicuous *Moleculæ*; afterwards, theſe again uniting, and faſtening to each other, form large thin maſſes, appearing like *Nubeculæ*, or clouds in the water, which grow more thick and opake by the continual appulſe of freſh matter; and if the ſaid matter be chiefly of the vegetable kind, it will be ſuſtained in the water, and diſcover at length a green colour, becoming ſtill more green, as the matter thickens and increaſes; but if there be any conſiderable quantity of mere mineral matter in the water, this being of a greater ſpecific gravity than the vegetable, as its particles unite to form *Moleculæ*, their impetus of gravity muſt ſurpaſs that of the reſiſtance of the water, and a great deal thereof ſubſide to the bottom, and being frequently intangled in the vegetable *Nubeculæ*, muſt force them down therewith: Now the queſtion is, to which of theſe, whether the water, or the earthy matter ſuſtained therein, vegetables owe their growth and increaſe? For deciding of which the following experiments may afford ſome light, having been made with due care and exactneſs.

The Doctor choſe ſeveral glaſs-phials, that were all, as near as poſſible, of the ſame ſhape and bigneſs; after putting what water he thought fit into every one of them, and taking an account of the weight thereof, he tied cloſe over the orifice of each phial a piece of parchment, with a hole in the middle, large enough to admit the ſtem of the plant he deſigned to ſet therein, without ſtraitening it ſo as to impede its growth; the Doctor's intention in this, was to prevent the incloſed water from evaporating, or aſcending by any other way than thro' the plant that is to be ſet therein; then he made choice of ſeveral ſprigs of mint, and other plants that were, as near as he could poſſibly judge, equally freſh, ſound, and lively, and having taken the weight of each, he placed it in a phial, ordered as above; and as the plant imbibed, and drew off the water, the Doctor took care to add more of the ſame from time to time, keeping an account of the weight of

of all he added; each of the glaſſes, for better diſtinction, had a different mark or letter, as A, B, C, &c. and all ſet in a row in the ſame window, ſo that all might partake alike of air, light, and ſun; thus they continued from *July* the 20th to *October* the 5th, juſt 77 days; then he took them out, weighed the water in each phial, and the plant likewiſe, adding to its weight that of all the leaves that had fallen off, during the time it ſtood thus; and laſtly, he computed how much each plant had gained, and how much water was ſpent upon it, the particulars are as follow:

Diſtinction of the Glaſſes.	*The ſeveral Sorts of Plants and Water.*	*Weight of Plant when put in.*	*Weight of Plant when taken out.*	*Weight gained in 77 Days.*	*Expence of Water.*	*The Proportion of the Encreaſe of the Plant to the Expence of Water.*
A.	Common *Spear-Mint* ſet in *Spring-water.*	gr. 27	gr. 42	gr. 15	gr. 2558	1, *to* 170$\frac{2}{5}$
B.	Common *Spear-Mint*, in *Rain-water.*	28$\frac{1}{4}$	45$\frac{3}{4}$	17$\frac{1}{2}$	3004	1, *to* 171$\frac{33}{85}$
C.	Common *Spear-Mint*, in *Thames-water.*	28	54	26	2493	1, *to* 95$\frac{31}{36}$
D.	Common *Solanum*, or *Night-Shade*, in *Spring-water.*	49	106	57	3708	1, *to* 65$\frac{3}{37}$
E.	*Lathyris, ſeu Cataputia Gerb.* in *Spring-water.*	98	101$\frac{1}{2}$	3$\frac{1}{2}$	2501	1, *to* 714$\frac{7}{8}$

The common *Solanum* in the phial D had ſeveral buds upon it when firſt ſet in the water, theſe in a few days became fair flowers, which were at length ſucceeded by berries; the two phials F and G were filled, the former with rain, the other with ſpring-water at the ſame time as thoſe abovemention'd were, and ſtood as long; but neither of them had any plant; his deſign in theſe was only to inform himſelf, whether any water exhaled out of the glaſſes, otherwiſe than thorough the bodies of the plants; the orifices of theſe two were covered with parchment, perforated with

with a hole of the ſame bigneſs as the other phials; in this hole he ſuſpended a bit of ſtick about the thickneſs of the ſtem of one of the aforeſaid plants, but not reaching down to the ſurface of the included water, he put them in thus, that the water in thoſe might not have more ſcope to evaporate than that in the other phials; thus they ſtood in the ſame window with the reſt for 77 days, when upon examination he found none of the water in theſe either waſted or evaporated, tho' he obſerved both in them and in the reſt, eſpecially after hot weather, ſmall drops of water, not unlike dew, adhering to the inſide of the phials, *viz.* that part of them that was above the ſurface of the encloſed water; at the end of the experiment, the water in theſe two glaſſes that had no plants in them, exhibited a larger quantity of terreſtrial matter, than any of thoſe that had plants in them, the ſediment at the bottom of the phials being greater and the *Nubeculæ*, diffuſed thro' the body of the water, being thicker; and ſome of that which was in the others proceeded from certain ſmall leaves that had fallen from that part of the ſtems of the plants that was within the water, where they rotted and diſſolved; the terreſtrial matter in the rain-water was finer than that in the ſpring-water.

The Doctor repeated the experiment, where the plants were all ſpear-mint, the moſt kindly, freſh and ſprightly ſhoots he could chooſe; the water and the plants were weighed as above, and the phials were ſet in a line in a window facing the ſouth, where they ſtood from *June* 2d, to *July* 28th, which was juſt 56 days.

Diſtinction of the Phials.	*The ſeveral Sorts of Waters*	*Wt. of Plants when put in.*	*when taken out*	*Weight gained in 56 Days.*	*Expence of Water.*	*Proportion of the Growth of the Plant to the Expence of Water.*
		gr.	*gr.*	*gr.*	*gr.*	
H.	*Hyde-park Conduit Water.*	127	225	128	14190	1, *to* 110 $\frac{110}{128}$
I.	*Hyde-park Conduit Water.*	110	249	139	13140	1, *to* 94 $\frac{74}{139}$
K.	*Hyde-park Conduit Water, in which was diſſolv'd an Ounce and a half of common Garden Earth.*	76	244	168	10731	1, *to* 63 $\frac{147}{168}$
L.	*Hyde-park Water with the ſame Quantity of Garden Mould as in the former.*	92	376	284	14950	1, *to* 52 $\frac{182}{284}$
M.	*Hyde-park Water diſtilled off with a gentle Still.*	114	155	41	8803	1, *to* 214 $\frac{29}{41}$
N.	*Reſidue of the Water which remained in the Still after that in* M. *was diſtilled off.*	81	175	94	4344	1, *to* 46 $\frac{30}{94}$

The

The plant which was set in H was all along a very kindly one, having run up to above two foot in height; it had shot but one considerable collateral branch, but had sent forth several long roots, from which sprung very numerous lesser fibres, tho' small and short; these lesser roots came out of the larger ones, on two opposite sides for the most part; so that of each root the *Fibrillæ* appeared not unlike a small feather; to these *Fibrillæ* adhered pretty much terrestrial matter; in the water, which was at last thick and turbid, there was a green substance, resembling a fine thin conserve; I, was as kindly as the former, but had shot no collateral branches; and was much like the former in its roots, the water, and green substance: The plant in K, tho' it was annoyed with many small insects that happened to fix upon it, yet had shot very considerable collateral branches, and at least as many roots, as either that in H or I, having a much greater quantity of terrestrial matter adhering to their extremities; there was the same green substance here as in the two preceeding: The plant in L, was much more flourishing than any of the former, having several very considerable collateral branches and very numerous roots, to which the terrestrial matter adhered very copiously; the earth in both the glasses K, and I, was very sensibly and considerably wasted from what it was when first put in; there was the same sort of green substance here, as in those above: The plant in M, was pretty kindly and had two small collateral branches and several roots, tho' not so many as that in H or I, yet as much terrestrial matter adhering to them as those had; the water was pretty thick, having a great many small terrestrial particles swimming in it, and some sediment at the bottom of the glass, but without any of the green matter abovementioned: The water in N was very turbid, and was as reddish as ordinary beer; the plant in it was very lively, and had sent forth six collateral branches, and several roots: O was *Hyde-park* conduit water, in which was dissolved a drachm of nitre, and when the mint was set therein, it suddenly began to wither, and decay, and it died in a few days; as likewise did two more sprigs, set in it successively: In another glass the Doctor dissolved an ounce of good garden-mould and a drachm of nitre; in a third, half an ounce of wood-ashes and a drachm of nitre; but the plants in these throve no better than in the former: P was *Hyde-park* conduit-water; in this the Doctor fixed a glass tube about 10 inches long, the bore about $\frac{1}{6}$ of an inch in diameter, filled with very fine and white sand, which was kept from falling down out of the tube into the phial, by tying a thin piece of silk, over the lower

end; upon the immerſion of which into the water, this by little and little aſcended quite to the upper orifice of the tube; and yet in all the 56 days it thus ſtood, a very inconſiderable quantity of water had gone off, ſcarcely 20 grains, tho' the ſand continued moiſt up to the top to the very laſt day; the water had imparted a green tincture to the ſand, quite to the very top of the tube, and in the phial it had precipitated a greeniſh ſediment mixed with black; pretty much of the green ſubſtance deſcribed above adhered to the bottom and ſides of the tube, as far as it was immerſed in the water: Q. R. S, *&c.* are ſeveral plants ſet in phials, ordered in like manner as thoſe above in *October*, and the following colder months; theſe did not thrive near ſo much, nor did the water aſcend in near the quantity it did in the hotter ſeaſons, when the above trials were made.

Upon theſe experiments the Doctor makes the following reflections. 1. In plants of the ſame kind, the leſs they are in bulk, the ſmaller quantity of the fluid maſs in which they are ſet, is drawn off; the expence, or waſting of it, where the maſs is of equal thickneſs, being pretty nearly proportioned to the bulk of the plant; thus that in the glaſs marked A, which weigh'd only 27 grains, drew off but 2558 grains of the fluid; and that in B, which weighed only $28\frac{1}{4}$, took up but 3004 grains, whereas that in H which weighed 127 grains, ſpent 14190 grains of the liquid maſs: The water ſeems to aſcend up in the veſſels of plants in much the ſame manner as up a filtre, ſo that as a large filtre draws off more water than a leſſer, juſt ſo a plant, that has more and larger veſſels, takes up a greater ſhare of the fluid in which it is ſet, than one that has fewer and ſmaller ones can do.

2. The much greateſt part of the fluid maſs, that is thus drawn off, and conveyed into plants, does not ſettle nor abide there, but paſſes thro' their pores, and is exhaled up into the atmoſphere: The leaſt proportion of water expended was to the encreaſe of the plant, as 46 or 50 to 1; and in ſome the weight of the water drawn off was 100, 200, nay, in one above 700 times as much, as the plant had been augmented in its growth: This ſo continual an emiſſion and detachment of water in ſo great plenty from the parts of plants, affords us a manifeſt reaſon, why countries that abound in trees, and eſpecially the larger vegetables, ſhould be very obnoxious to damps, great humidity in the air, and more frequent rains, than others that are more open and free; nor does this moiſture go off pure and alone, but uſually carries away with it ſeveral parts of the ſame nature, with thoſe whereof the plant thro'

thro' which it passes, consists; the grosser particles indeed are not so easily borne up into the atmosphere, but are usually deposited on the surface of the flowers, leaves, and other parts of the plants; hence arise our manna, honey, and other gummous exsudations of vegetables; but the finer and lighter parts are with greater ease sent up into the atmosphere; and thence they are convey'd to our organs of smell by the air we draw in by respiration, and are pleasant or offensive, beneficial, or noxious, according to the nature of the plants from whence they arise; and since these owe their origin to the water, that ascends out of the earth thro' the bodies of plants, we cannot be far to seek for the cause, why they are more numerous in the air, and why we find a greater quantity of odours exhaling from vegetables in warm, humid seasons, than in any others whatever.

3. A great part of the terrestrial matter, that is mixed with the water, ascends up into the plants, as well as the water itself; for there was much more terrestrial matter at the end of the experiment in the water of the glasses F and G that had no plants in them, than in those that had; the garden mould dissolved in the glasses K and L was considerably diminished, and carried off; nay the terrestrial and vegetable matter was borne up in the tubes filled with sand, cotton, &c. in such a quantity as to be evident even to sense. Our shores and parts within the verge of the sea will present us with a large scene of plants, that along with the vegetables, take up mere mineral matter also, in great abundance; such are the sea-purslains, the several sorts of *Alga*'s, of samphires, and other marine plants, which contain common sea-salt which is all the same with the fossile, in such plenty, as not only to be plainly distinguished on the palate, but extracted from them in considerable quantities. How apt this vegetable matter, being so very fine, and light, is to attend water in all its motions and follow it into each of its recesses, is manifest from the instances above alledged and many others that might be given. The Doctor filtred water thro' several sheets of thick paper, and after that, thro' very close fine cloth, 12 times doubled, nay, he had done this over and over, and yet after all a considerable quantity of that vegetable matter discovered itself in the water; it is true filtering of water intercepts some of the earthy matter it was before impregnated withal; but then that which continues in the water after this, is fine and light, and such consequently as is in a peculiar manner fit for the growth and nourishment of vegetables; and this is the case of rain-water, where the quan-

tity of terreſtrial matter it carries up into the atmoſphere is not great; but what it does, is chiefly of that light kind of vegetable matter, and that too perfectly diſſolved and reduced to ſingle corpuſcles, all fit to enter the tubules and veſſels of plants; on which account it is that this water is ſo very fertile and prolific; but a great deal of the mineral matter is not only groſs and ponderous, but ſcabrous, and inflexible, and ſo not diſpoſed to enter the pores of the root; ſome of the ſimple vegetable particles unite by degrees and form ſmall clods or *Moleculæ*, ſuch as thoſe mentioned in H, K, and L, ſticking to the extremities of the roots of thoſe plants; others of them are entangled in a looſer manner, and form the *Nubeculæ*, and green bodies ſo commonly obſerved in ſtagnant waters; which, when thus conjoined, are too large to enter the pores, or aſcend up into the veſſels of plants, which ſingly they might have done; of this ſuch as are converſant in agriculture are well aware of, for let your earth be never ſo rich, good, and fit for the production of corn, or other vegetables, little will come of it, unleſs the parts be ſeparated and looſe, and 'tis on this account they beſtow the pains they do in the culture of it, in digging, plowing, harrowing and breaking the clodded lumps of earth; 'tis the ſame way, that ſea-ſalt, nitre and other ſalts promote vegetation, they looſen the earth and ſeparate its concreted parts, and by that means fit and diſpoſe them to be aſſumed by the water, and carried up into the ſeed and plant for its formation and increaſe; there is no man but muſt obſerve, how apt all ſorts of ſalts are to be wrought upon by moiſture, how eaſily they liquify and run with it; and when theſe are drawn off and have deſerted the lumps wherewith they are incorporated, thoſe muſt moulder immediately, and fall aſunder of courſe; the hardeſt ſtone we meet with, if it happen, as frequently it does, to have any ſort of ſalt intermixed with the ſand of which it conſiſts, upon being expoſed to a moiſt air, in a ſhort time diſſolves and crumbles all to pieces, and much more will cloded earth or clay, which is not of near ſo compact and ſolid a contexture as ſtone is: The ſame way likewiſe is lime ſerviceable in this affair, it being well known how apt it is to be put into fermentation and commotion by water, nor can ſuch commotion ever happen, when lime is mixed with earth, however hard and cloded that may be, without opening and looſening of it. 4. The plant is more or leſs nouriſhed and augmented, in proportion as the water, in which it ſtands, contains a ſmaller or greater quantity of proper terreſtrial matter in it; the truth of which

which propoſition is eminently diſcernable thro' the whole proceſs of theſe trials; the mint in the glaſs C was much of the ſame bulk and weight with thoſe in A and B; but the water in which C was, being river-water, which was apparently ſtored more copiouſly with terreſtrial particles than the ſpring or rain-water, wherein A and B ſtood, it had thriven to almoſt double the bulk that either of them had, and with a leſs expence of water too; ſo likewiſe the mint in L, in whoſe water was diſſolved a ſmall quantity of good garden-mould, tho' it had the diſadvantage when firſt ſet, to be leſs than either of the mints in H or I, whoſe water was the very ſame with this in L, but without any of that earth mixed with it, yet in a ſhort time the plant L not only overtook, but much outſtripped thoſe, and at the end of the experiment was conſiderably larger and heavier than either of them; in like manner the mint in N, tho' leſs at the beginning than that in M, being ſet in the thick, turbid, feculent water that remained behind, after that, wherein M was placed, was diſtilled off, had more than double its original weight and bulk, and received above twice the additional increaſe of the plant in M, which ſtood in the thinner diſtilled water; and what is no leſs conſiderable, had not drawn off half the quantity of water that that had; the reaſon why the Doctor limits the proportion of the augment of the plant to the quantity of proper terreſtrial matter in the water, is, becauſe all, even the vegetable matter, to ſay nothing of the mineral ſort, is not proper for the nouriſhment of every plant; there may be, and doubtleſs there are ſome parts in different ſpecies of plants that may be much alike, and ſo owe their ſupply to the ſame common matter, but it is plain, all cannot; and there are other parts ſo differing, that it is no ways credible they ſhould be formed all out of the ſame ſort of corpuſcles; ſo far from it, that there are not wanting good indications, as ſhall be ſeen by and by, that every kind of vegetable requires a peculiar and ſpecific matter for its formation and nouriſhment; yea, each part of the ſame vegetable does ſo, and there are ſeveral different ingredients that go into the compoſition of the ſame individual plant: If therefore the ſoil, wherein any vegetable or ſeed is planted, contains all or moſt of theſe ingredients, and thoſe in a proper quantity, it will grow and thrive there, otherwiſe it will not; if there be not ſo many ſorts of corpuſcles, as are requiſite for the conſtitution of the main and more eſſential parts of the plant, it will not thrive at all; if there be theſe, and they not in ſufficient plenty, it will ſtarve, and never arrive

arrive to its natural ſtature; or if there be any the leſs neceſſary and eſſential corpuſcles wanting, there will be ſome failure in the plant, either in taſte, ſmell, colour, or ſome other way: Tho' a tract of land may happen not to contain matter proper for the conſtitution of ſome one peculiar kind of plant, yet it may for ſeveral others, and thoſe differing much among themſelves; the vegetative particles are blended together in the earth, with all the diverſity and variety, as well as with all the uncertainty conceivable; ſo that it is not poſſible to imagine, how one, uniform, homogeneous matter, having its principles or original parts all of the ſame ſubſtance, conſtitution, magnitude, figure, and gravity, ſhould ever conſtitute bodies ſo egregiouſly unlike in all thoſe reſpects, as vegetables of different kinds are, nay, even as the different parts of the ſame vegetable; that one ſhould carry a reſinous, another a milky, a third a yellow, a fourth a red juice in its veins; one affords a fragrant, another an offenſive ſmell; one may be ſweet to the taſte, another bitter, acrid, acerb, auſtere, *&c.* that one ſhall be nouriſhing, another poiſonous, one purging, another aſtringent; in ſhort, that there ſhould be that vaſt difference in them, as to their ſeveral conſtitutions, make properties and effects, and yet all ariſe from the very ſame ſort of matter, ſeems to be very ſtrange.

The *Cataputia* in the glaſs E received but very little increaſe, only 3 ½ grains all the while it ſtood there, tho' 2501 grains of water were ſpent upon it; the reaſon of this, may be that the water was not a proper medium for it to grow in; and it is known, that ſeveral plants will not thrive in it; too much of that liquor in ſome plants may probably hurry the terreſtrial matter thro' their veſſels too faſt for them to attract, and lay hold of it; be that as it will, it is moſt certain that there are peculiar ſoils that ſuit peculiar plants; in *England*, cherries are obſerved to thrive beſt in *Kent*, apples in *Herefordſhire*, ſaffron in *Cambridgeſhire*, wood in two or three of our midland counties, and teaſles in *Somerſetſhire*; this is an obſervation that hath held in all parts of the world: Yet that ſoil that is once proper for the production of ſome one ſort of vegetable, does not ſtill continue to be ſo; for, in proceſs of time it loſes that property, but ſooner in ſome lands, and later in others; if wheat, for example, be ſown upon a piece of land, that is proper for that grain, the firſt crop will thrive very well, and perhaps the ſecond and the third, as long as the ground is in heart, as the farmers call it; but in a few years it will produce no more, if ſow'd with that grain; it is true, it may ſome other, as barley; and after this has been ſown ſo often,

that

that the land can bring forth no more of that kind, it may afterwards yield good oats, and perhaps peaſe after all theſe; at length it will become barren, the vegetative matter, that it at firſt abounded in, being extracted from it by thoſe ſucceſſive crops, and moſt of it borne off; for each ſort of grain extracts from it that peculiar matter that is proper for its own nouriſhment: After all this, that very tract of land may be brought to produce another ſeries of the ſame vegetables; but never till it is ſupplied with a new fund of matter, of like ſort with that it at firſt contained; which ſupply is made ſeveral ways, either by the ground's lying fallow ſome time, till the rain has poured down a freſh ſtock upon it, or by the farmer's care in manuring it: And for further evidence that this ſupply is in reality of a like ſort, we need only reflect a while upon thoſe manures that are found by conſtant experience, beſt to promote vegetation and the fruitfulneſs of the earth; and theſe are chiefly parts of vegetables or animals, which indeed derive their own nouriſhment immediately either from vegetable bodies, or from other animals that do ſo; in particular the blood, urine and excrements of animals, ſhavings of horns and of hoofs, hair, wool, feathers, calcined ſhells, lees of wine and beer, aſhes of all ſorts of vegetable bodies, leaves, ſtraw, roots and ſtubble turn'd into the earth by plowing or otherwiſe, to rot and diſſolve there, all theſe prove the beſt manures, and being vegetable ſubſtances, when refunded back again into the earth, ſerve for the formation of other like bodies: We meet with ſtill further confirmations of the ſame thing in our gardens; the trees, ſhrubs, and herbs cultivated there, after they have continued in one ſtation, till they have derived thence the greater part of the matter proper for their increaſe, will decay and degenerate, unleſs either freſh earth, or ſome proper manure be applied to them: It is true they may maintain themſelves there for ſome time, by ſending forth roots further and further to a great extent all around, to fetch in more remote proviſion; but at laſt all will fail, and they muſt either have a freſh ſupply brought to them, or they themſelves be tranſplanted to ſome places better furniſhed with matter for their ſubſiſtence; and accordingly gardeners obſerve, that plants that have ſtood a great while in a place, have longer roots than uſual, part of which they cut off, when they tranſplant them to a freſh ſoil, as now not of any further uſe to them, ſo that all theſe inſtances, and a great many others that might be alledged, point forth a particular terreſtrial matter, and not water only, for the ſubject to which plants owe their increaſe; for were it water only,

there

there would be no need of manures, nor of tranſplanting them from place to place, ſince the rain falls in this field and in that indifferently, in one ſide of an orchard or garden, as well as in another; nor could there be any reaſon, why a tract of land ſhould yield wheat one year and not the next, ſince the rain ſhowers down alike in each. 5. Vegetables are not formed of water, but of a certain peculiar terreſtrial matter: The plant in E attracted 2501 grains of the fluid maſs, and yet had received but 3 grains and an half of increaſe from all that quantity; the mint in L, tho' it had at firſt the diſadvantage to be much leſs than that in I, yet being ſet in water wherewith earth was plentifully mixed, and that in I only in water without any ſuch additional earth, the former had vaſtly outgrown the latter, weighing at leaſt 145 grains more than it, and ſo had gained above twice as much; in like manner that in K, tho' it was a great deal leſs when put in the water, than that in I, and was alſo injured and impaired by inſects; yet by being planted in water wherein earth was diſſolved, whereas the water wherein I ſtood had none, it not only overtook, but conſiderably ſurpaſſed the other, weighing at laſt 29 grains more than that in I, and had not expended ſo much water as that, by above 2400 grains; the plant in N, tho' at firſt a great deal leſs than that in M, yet being ſet in the foul craſs water, that was left in the ſtill, after that, in which M was ſet, was drawn off, it at laſt gained in weight above double what that in the thinner and finer water had done; the proportion of the augment of that plant that throve moſt, was to the fluid maſs as 1 to 46; nay, in the *Cataputia* it was but as 1 to 714: The mint in B took up 39 grains of water a-day, one day with another, which was much more than the whole weight of the plant originally, and yet with all this it gained not in weight one fourth of a grain a day; that in H took up 253 grains of the fluid a day, which was near twice as much as its original weight, it weighing when firſt ſet in the water but 127 grains, and after all, the daily increaſe of the plant was no more than $2\frac{1}{10}$ grains. 6. Spring and rain-water contain pretty near an equal charge of vegetable matter, and river-water more than either of them; the plants in the glaſſes A, B, C, were at firſt of much the ſame ſize and weight; at the end of the experiment the mint in A had gain'd 15 grains out of 2558 grains of ſpring-water; that in B $17\frac{1}{2}$ grains out of 3004 grains of rain water; but that in C had got 26 grains only, out of 2493 grains of river-water; ſo that theſe proportions will hold in the main; notwithſtanding this, the Doctor does not doubt, but the water that falls in rain at ſome-

at ſome times contains a greater ſhare of terreſtrial matter, than that which falls at others; a more powerful and intenſe heat muſt needs carry up a larger quantity of that matter with the humid vapours that form rain, than one more feeble and remiſs ever poſſibly can; the water in one ſpring may flow out with an higher charge of this matter, than that of another, thus depending partly upon the quantity of the ebullition of the water, and partly upon the quickneſs of the ebullition of the water, and partly upon the quantity of that matter, latent in the *Strata*, thro' which the fluid paſſes, and the greater or leſs laxity of thoſe *Strata*; for the ſame reaſon, the water of one river may abound with it more than that of another; nay, the ſame river, when much agitated, muſt bear up more of it, than when it moves with leſs rapidity and violence: That there is a great quantity of this matter in rivers, and that it contributes vaſtly to the fertility of the earth, we have an illuſtrious inſtance in the *Nile*, the *Ganges*, and other rivers, that yearly overflow the neighbouring plains, which thereby ſhew the faireſt and largeſt crops of any in the whole world. 7. Water ſerves only for a vehicle to the terreſtrial matter, which forms vegetables, and does not itſelf, make any addition to them; where the proper terreſtrial matter is wanting, the plant is not augmented, tho' never ſo much water aſcends into it; the *Cataputia* in E took up more water than the mint in C, and yet had grown but very little, having received only 3 ½ grains of additional weight; whereas that in C had received no leſs than 26 grains; the mint in I was planted in the ſame ſort of water, as that in K was, only that the latter had earth diſſolved in the water, and yet the former drew off 13140 grains of the water, gaining itſelf no more than 139 grains in weight; whereas, that in K attracted but 10731 grains of water, and was augmented 168 grains in weight, conſequently the former ſpent 2409 grains more of the water, than this in K did, and yet was not ſo much increaſed in weight as this by 29 grains; the mint in M ſtood in the very ſame kind of water, as that in N did; but the water in M having much leſs terreſtrial matter in it, than that in N had, the plant bore up 8803 grains, itſelf gaining the while only 41 grains; whereas that in N attracted no more than 4344 grains, and yet was augmented 94 grains; ſo that it ſpent 4459 grains of water more than that in N did; and yet was not itſelf ſo much increaſed in weight as that in N by 53 grains; this is both a very fair and a very concluſive inſtance, that water is not the matter that compoſes vegetable bodies, but is the agent that conveys that matter to them, that introduces and

diſtributes it to the ſeveral parts for their nouriſhment; that therefore, there is that plentiful proviſion and vaſt abuudance of it ſupplied to all the parts of the earth, is a mark of a natural providence, ſuperintending over the globe we inhabit.

This fluid is fitted for the office here aſſigned it ſeveral ways; firſt by the figure of its parts, which as appears from ſeveral experiments, is exactly and mathematically ſpherical, the ſurfaces being perfectly ſmooth, and without any the leaſt inequality; ſo that it is evident, corpuſcles of ſuch a figure are eaſily ſuſceptible of motion, yea, far above any others whatever, and conſequently the moſt capable of moving and conveying other matter that is not ſo active and moveable than the interſtices between bodies of that figure are with reſpect to their bulk, of all others the greateſt, and ſo moſt adapted for receiving of foreign matter; beſides, as far as trials hitherto made, inform us, the conſtituent corpuſcles of water are each, ſingly conſider'd, abſolutely ſolid, and do not yield to the greateſt external force, which ſecures their figure againſt any alteration; and conſequently, the interſtices between the corpuſcles muſt be always alike; by the latter it will ever be diſpoſed to receive matter, and by the former, when receiv'd, to convey it along with itſelf: Water is farther fitted to be a vehicle to this matter, by the tenuity, and fineneſs of the corpuſcles of which it conſiſts; we hardly know any fluid in nature, except fire, whoſe conſtituent parts are ſo exceeding ſubtile and ſmall as thoſe of water are; they paſs thro' pores and interſtices, that neither air nor any other fluid can; this enables them to enter the fineſt tubes and veſſels of plants, and introduce the terreſtrial matter, conveying it to all their parts; whilſt each, by means of organs it is endowed with for that purpoſe, intercepts and aſſumes to itſelf ſuch particles as are ſuitable to its nature; letting the reſt paſs on thro' the common ducts; nay we have almoſt every where mechanical inſtances of much the ſame nature: It is obvious to every one how eaſily and ſuddenly humidity or the corpuſcles of water ſuſtained in the air, pervade and inſinuate themſelves into cords, however tightly twiſted, into leather, parchment, vegetable bodies, wood and the like; and this it is that fits them for hygrometers, to meaſure and determine the different quantities of moiſture in the air, in different places and ſeaſons. 8. Water is not capable of performing this office to plants, unleſs it be aſſiſted by a due quantity of heat, which muſt needs concur, elſe vegetation will not ſucceed: The plants that were

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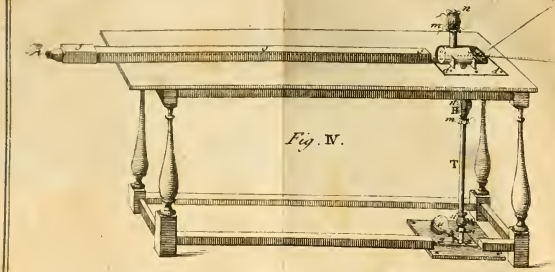
ſet in the glaſſes Q, R, S, &c. in *October* and the following colder months, had not near the quantity of water conveyed into them, nor ſo great an additional increaſe by much, as thoſe that were ſet in *June*, *July*, and the hotter months; 'tis plain that water has no power of moving itſelf, or of riſing to that vaſt height it does in the more tall and lofty plants; ſo far from it, that it does not appear from any diſcovery yet made that its fluidity conſiſts in the inteſtine motion of its parts, there being no need of any thing more, to ſolve all the phenomena of fluidity, than ſuch a figure and diſpoſition of parts as water has; for corpuſcles of ſuch a make, and that are all abſolutely ſpherical, muſt have ſo little contact with each other, as to be always ſuſceptible of every the lighteſt impreſſion imaginable to put them into motion; it is true, the parts of fire are not capable of moving themſelves any more than thoſe of water; but being more ſubtile, light, and active than theſe are, they are more eaſily put into motion: In fine, it is evident, and matter of fact, that heat operates upon and moves the water, in order to its carrying on the work of vegetation.

That the concourſe of heat is really neceſſary in this work, appears not only from the experiments before us, but likewiſe from all nature, in fields, foreſts, gardens and orchards; for we ſee in autumn, as the power of the ſun grows gradually leſs and leſs, ſo its effects on plants do remit, and their vegetation ſlackens by little and little; its failure is firſt diſcernible in trees, which being raiſed higheſt above the earth, require a more intenſe heat to elevate the water, charged with their nouriſhment to the extreme parts; ſo that for want of freſh nutriment they ſhed their leaves, unleſs they are ſecured by a very firm and hardy conſtitution as our ever greens are; next the ſhrubs ſhed their leaves, and then the herbs and lower tribes; the heat at length not being ſufficient to ſupply even theſe, tho' ſo near the earth, with an adequate fund of nouriſhment; as the heat returns the ſucceeding ſpring, they all recruit again, being furniſhed with freſh ſupplies and verdure; and firſt of all thoſe which are loweſt and neareſt the earth, as herbs and ſuch plants as require a leſſer degree of heat to raiſe up the water with its earthy particles into them; then the ſhrubs and higher vegetables in their turns, and laſtly the trees: But as the heat increaſes, it grows too powerful, and hurries the earthy matter with too great rapidity thro' the more delicate plants, which therefore go off and decay; whilſt others that are more hardy, and vigorous, and require a greater ſhare

of heat, thrive; by which mechaniſm provident nature furniſhes us with a very various and different entertainment, and what is beſt ſuited to each ſeaſon, all the year round.

As the heat of the ſeveral ſeaſons affords us a different face of things, ſo the ſeveral diſtant climates ſhew different ſcenes of nature, and productions of the earth: The hotteſt countries ordinarily yield the largeſt and talleſt trees, and thoſe too, in much greater variety than the colder ever do; even thoſe plants, which are common to both, attain to a much greater bulk in the ſouthern than in the northern climates; nay there are ſome regions ſo bleak and chill, that they raiſe no vegetables at all to any conſiderable ſize; this we learn from *Greenland*, *Iceland* and other places of ſuch like cold ſituation, where no trees ever appear, and the very ſhrubs they afford are few, ſmall, and low. Again in warmer climates, and ſuch as yield trees and the larger vegetables, if there happen a remiſſion or diminution of the uſual heat, their productions will be impeded, and diminiſhed in proportion; which is alſo plainly evinced by a cold ſummer; for tho' the heat may be ſufficient to raiſe the vegetative matter into the lower plants, into cords, as wheat, barley, peaſe and the like; and tho' we may have plenty of ſtrawberries, rasberries, currans, goosberries, and the fruits of ſuch other vegetables, as are low and near the earth; yea, and a moderate ſtore of cherries, mulberries, plums, filberts, and ſome others, that grow ſomewhat higher, yet apples, pears, walnuts, and the productions of the taller trees are fewer, and thoſe not ſo kindly, ſo thoroughly ripened, and brought to that perfection that they are at, in a more benign and warmer ſeaſon. Nay, in ſuch a cold ſummer, even the lower fruits and grains have ſome ſhare in the common calamity; and fall ſhort both in number and goodneſs of what the hotter and kindlier ſeaſons are wont to ſhew us: As to our grapes, apricocs, peaches, nectarins, and figs, being tranſplanted hither out of hotter climates, it is the leſs wonder if in ſuch a caſe there be a general failure of them.

Nor is the ſun, nor the ordinary emiſſion of the ſubterraneous heat only, that promotes vegetation, but any other heat indifferently, according to its power and intenſeneſs, as we ſee by our ſtoves, hot-beds, and the like: All heat is of a like kind; and wherever the ſame cauſe is, there will conſtantly be the ſame effect; there is a procedure in every part of nature, that is perfectly regular and geometrical, if we can but find it out; and the further our ſearches carry us, the more ſhall we have occaſion to admire, and the better it will compenſate our labour. *An*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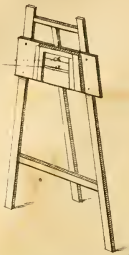

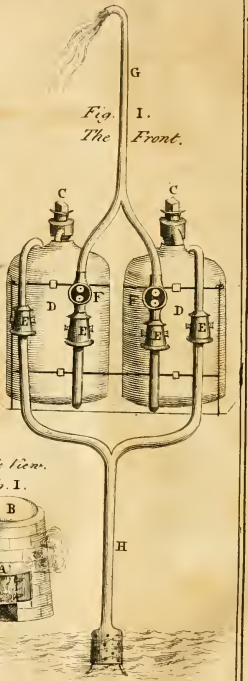
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Fig. I.
The Front.
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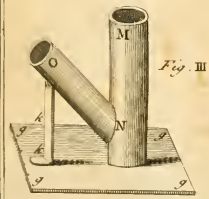
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Fig. III.

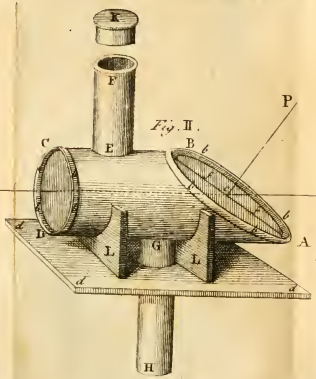
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Fig. II.
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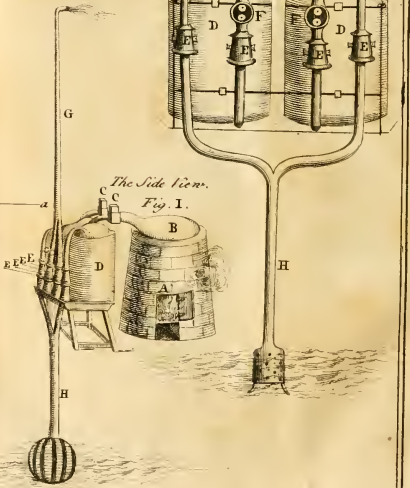
G
The Side View.
Fig. I.
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An Engine *for raiſing* Water *by the Help of Fire*; *by Mr.* Tho. Savery. Phil. Tranſ. N° 253. p. 228.

IN Plate XI. Fig. 1. A repreſents the furnace; B the boiler; C, C, two cocks, which convey the ſteam by turns to the veſſels D, D; D, D, the veſſels which receive the water from the bottom, in order to diſcharge it again at the top; E E E E are the valves; F, F, the cocks which keep up the water, while the valves are on occaſion, a cleanſing; G the force-pipe; H the ſucking-pipe; I the water.

An Account of Loch Neſs, *&c. by Mr.* James Fraſer, *of* Kirkhill. Phil. Tranſ. N° 254. p. 230.

LOch Neſs, according to the tradition of the highland bards, took its name from one *Nyſus* an *Iriſh* hero, who, together with *Dornadilla* his wife, ſettled a colony in *Strath-harig*; the promontory, upon which he had his reſidence, is to this day called *Doun Dearnill*, from the name of his wife; and becauſe he was the firſt that ever attempted to fit out boat, or barge, upon this lake, it is after him called *Loch Neſs*; it is 24 miles in length, and in moſt places two in breadth; one *Geo. Scot* ſounded it with 500 fathoms, and Capt. *Orton* with a whole barrel of plumb-lines, but they could find no bottom; the banks of this lake are high, rocky, and mountainous, and covered with woods; the lake never freezes, which is imputed to a great number of large ſprings in it; the only fiſh therein is ſalmon; this lake diſcharges itſelf into a river of the ſame name, ſix miles in length, which never freezes, but always ſmoaks in froſty weather, from which ſmoak is ſpread a fog all over the adjacent country; upon the north ſide of *Loch Neſs*, ſtands on a rock the famous caſtle of *Urquhart*, the great ditch round it was for the moſt part cut out of the rock, and received water from the lake; this caſtle conſiſted of ſeven great towers, and it is ſaid to be built by the *Cuming's*, but was demoliſhed by King *Edward* I. of *England*, leaving only one tower to the eaſt, which remains to this day: About four miles to the weſtward of this caſtle, upon the ſide of *Loch Neſs*, ſtands that great mountain called *Meal-ſuor-vouny*, of a round, neat, high ſhape, being two miles of perpendicular height from the *Loch*; upon the very top of this hill is a lake of cold freſh water, about 30 fathoms long and ſix broad, no courſe or ſtream of water viſibly runs either to or from it; Mr. *Fraſer* plumb'd it with 100 fathoms of ſmall line, but could find no bottom; it is always equally full, and never freezes: There is

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due weſt from the mouth of the river *Neſs* an arm of the ſea, called *Bewley-firth*, ſix miles long, and half a mile broad; this channel, Mr. *Fraſer* thinks, was formerly firm land; for near the middle of it were found large oak trees with their roots entire, ſome above 60 foot long, lying covered in the ſand, and he doubts not but they grew there; and for further confirmation hereof, there are three great heaps of ſtone in the *Firth*, at a conſiderable diſtance from each other, theſe are called *Cairns* in *Iriſh*; one of them of a huge largeneſs, in the middle of the *Firth*, is acceſſible at low-water; and it appears to have been a burial place, by the urns which are ſometimes found there; as the ſea encroaches upon, and wears the banks upwards, there are found oaken beams of 20 or 30 foot long, ſome of them 8, others 12 or 14 foot under ground; Mr. *Fraſer* ſaw one of them 14 foot long, that had the marks of the ax upon it, with ſeveral wimble-bores therein; the river of *Bewley*, that falls into this arm of the ſea, near *Lovat*, hath ſunk ſo low in its channel, that oaken trees of incredible length, and 16 foot under ground, have been found in the banks, with layers of ſand, gravel, clay, and earth over them; and at another time he ſaw ſome oaks with coals, and pieces of burnt timber as low as 16 foot, or thereabouts: About 17 miles due weſt from *Bewley*, there is a foreſt called *Affaruck*, in which there is a mountain called *Glennin-tea*; and on the north-ſide, under the ſhade of a great ſloping rock, ſtands a lake of freſh water, called *Lochan Wyn*, or green lake, 18 foot in diameter, and about a fathom deep, which is always covered with ice both ſummer and winter; the next mountain, to the north of that, is called *Scure-in-lappich*, on the top of which is a vaſt heap of white ſtones, like cryſtal, each of them larger than a man can throw, they ſtrike fire like flint, and have the ſmell of ſea-weed; there is alſo found upon this mountain great plenty of oyſter, ſcallop, and limpet-ſhells, tho' 20 miles from any ſea; round this hill grows the ſea-pink, in *Iriſh*, *Teartag*, having the colour and taſte of that which grows on the ſea-ſhore: The *Pagan* temples, or places of idolatry, are very numerous here; for upon the ſide of the river *Narden*, Mr. *Fraſer* reckoned 13 in the ſpace of 2 miles, they are of a round figure, and at the weſt end have two high ſtones like pyramids; there is an outer and inner circle of leſſer ſtones, and a round moat in the centre for the ſacrifices; another ſort of theſe places of worſhip is only of earth, with a trench round about them, and a moat in the middle; in ſeveral of theſe Mr. *Fraſer* found a round heap of ſtones with urns in them; it ſeems a different religion did afterwards turn theſe places of worſhip into burial-grounds.

The

The Manner of Concoction; *by Dr.* Clopton Havers. Phil. Tranſ. N° 254. p. 233.

THE ſentiments of phyſicians, about the manner how the digeſtion of the aliment is performed, have been various, and the hypotheſes, by which they have endeavoured to explain it, very different; ſome have been of opinion, that it is a kind of elixation, and that the groſſer and more ſolid parts being, as it were, boiled in the fluid by the heat of the ſtomach, and the parts adjacent thereto, as the liver, ſpleen, and *Omentum*, are by a long and continued elixation firſt rendred more tender, and then colliquated and diſſolved into minuter particles, ſo as to mix more equally with the fluid, and therewith to make one pulp or chylous maſs; and tho' *Hippocrates* does not plainly call it an elixation, yet he ſeems to attribute the concoction of the food to the heat of the ſtomach, as its great cauſe: Others have ſuppoſed it to be performed by attrition; as if the ſtomach, by thoſe repeated motions, which are the neceſſary effects of reſpiration, when it is diſtended by the aliment, did both rub or grind off ſome minuter particles from the groſſer parts, and by continually agitating the maſs of food, make thoſe parts of it, which are not contiguous to the ſtomach, ſtrike one againſt another, and break one or the other into pieces, till they are all attenuated; as for bread and ſuch things as are made of flour, that may be ſoftened and diſſolved with any common liquid, tho' that agitation of the ſtomach, which moves them in reſpiration, might ſeem ſufficient to break and diſſolve them; yet this cannot be thought ſufficient to break and digeſt fleſh-meat, fruits, or any other thing that will not be ſoftned and diſſolved in water, or ſome ſuch liquid; but altho' this motion of the aliment, cauſed by reſpiration, does not actually digeſt it, yet it has a great and neceſſary uſe in concoction, and makes all the groſſer parts as they are attenuated, mix equally with the fluid parts: Others think that the bilious juice, others again, that the ſpirits are chiefly concerned in this affair; *Galen* makes it the effect not of one, but of ſeveral cauſes; as the pituitous juice in the ſtomach, the bile, *&c.* Some there are that will have the food diſſolved by a menſtruum, ſupplied from the glands of the ſtomach, or ſome other way; but theſe differ in their notions of the nature of the menſtruum; for there are ſome that ſuppoſe it to be an acid, which corrodes the groſſer parts of the food, and diſſolves them in the ſame manner; as vinegar, ſpirit of vitriol, *&c.* which even diſſolve ſuch a ſolid body as iron; and tho' it cannot be denied

nied but that oil of vitriol will diſſolve fleſh and reduce it to a pulp; yet it is not to be ſuppoſed, that the fibres of the ſtomach can bear any ſuch ſtrong and corroding acid, without being injured in its tone, and without being effected with great and extraordinary pains; neither does ſuch a menſtruum, tho' it will digeſt ſome bodies, ſeem capable of diſſolving ſo great a variety of things as we eat, eſpecially when a great many of them are of a contrary nature to each other: Some will have the menſtruum to be a nitro-aereous ſpirit, ſubtile, and very penetrating, and included in its proper vehicle, which, being in its own nature apt to penetrate the maſs of the aliment, diffuſes itſelf thro' the whole, and breaking the coheſion of the moſt ſolid parts, diſſolves their compages: By others, it is thought to be ſome ſaline juice in the ſtomach, by which the parts of the aliment are divided and diſſolved, and thoſe fit for nouriſhment volatilized: Laſtly, there are ſome, who ſuppoſe, that digeſtion is performed by means of a ferment, which, when mixed with the aliment, excites in the maſs an inteſtine motion; and the different and contrary motions or tendencies of the parts, by making ſome kind of colliſion, gradually break off particles from the groſſer and more ſolid parts, till they are ſo attenuated, as to be apt to mix more equally with the fluid parts, and with them conſtitute one ſoft or chylous ſubſtance; but theſe alſo differ, either as to the nature of this ferment, or the manner wherein it is ſupplied; for ſome take it to be the remains of the food that was laſt digeſted, which having lain ſome time in the ſtomach, after the reſt is carried down into the inteſtines, contract an acid or ſome ſuch quality, and become ſo altered as to partake of the nature of a leaven; and this leaven being a part of the food, which has been already digeſted, is ſo ſoft and liquid, as to be capable of mixing with the aliment, which is next taken into the ſtomach, and being agitated therewith by the repeated preſſures of the diaphragm, liver and abdominal muſcles upon the ſtomach in reſpiration, diffuſes itſelf thro' the whole maſs, and being mixed with it like leaven, or yeaſt added to new wort, *&c.* puts it into a ſtate of fermentation; and by this fermentation, or by the expanſion of the ferment, and the more ſubtile parts, which are firſt put into motion thereby, thoſe parts, which are more ſolid, and with which they are intermixed, are rent and divided and attenuated in ſuch a manner, as to become a ſoft and pulpous matter; and altho' the greateſt part of the food, that is thus broken and concocted, is by the contraction of the fibres of the ſtomach preſſed into the *Duodenum*, yet they do not contract them-

themſelves in ſuch a manner, as to force out all the aliment, but there is left between the *Rugæ* or folds on the inſide of the ſtomach, a ſufficient quantity to be a leaven to the next meal, and ſo on from time to time: Some entertain a notion, that this ferment, or principle of fermentation, is in the aliment itſelf, which being a congeries of matter conſiſting of various parts of a different nature, is no ſooner incloſed in the ſtomach, and digeſted in the heat of that, and the adjacent parts, but the more ſpirituous and ſubtile particles are put into motion, and enter upon a fermentation, both from that warmth and from the difference of their natures; and ſo by their inteſtine commotion and the violence they offer to thoſe parts which oppoſe the tendency of any of them, they break and diſſolve the more ſolid parts: Again, ſome are of opinion, that this ferment is ſupplied from the glands of the ſtomach; and laſtly, others, and perhaps with much better reaſon, contend for the *Saliva* or ſpittle, and make that the ferment, which principally ſerves for the digeſtion of the food; for the *Saliva* being mixed with our food in maſtication, is with it carried downwards into the ſtomach, where its parts being put into motion by a kindly and agreeable heat, they ferment with, and agitate firſt thoſe parts of the food, which are moſt apt to ferment therewith; and then both conſpire together to break and diſſolve the groſſer, and more ſtubborn parts: *Galen* plainly allows that the *Saliva* is concerned in the buſineſs of concoction, tho' he ſuppoſes the alteration produced by this juice to be made in the mouth.

But according to Dr. *Havers*'s hypotheſis, concoction is performed after this manner; for the more eaſy and effectual digeſtion of the food, nature has appointed ſome parts for the breaking of our aliment, and reducing whatever is groſs into ſmaller parts, before it is put upon digeſtion; and others to ſupply the ferment, by which it is to be diſſolved and concocted, and which, before it is included in the ſtomach, ſerves to moiſten and make it more ſoft, that it may be more eaſily penetrated and broken by thoſe parts, which ſerve to divide every morſel into ſmaller pieces: For the breaking of that part of our food, which is not liquid, nature has furniſhed us with teeth, and thoſe of two ſorts; ſome are appointed to divide and break off ſmaller morſels from a larger maſs; others are made for the grinding thoſe morſels into much ſmaller parts; the teeth which ſerve to break off pieces of a convenient magnitude from a larger maſs are of two ſorts, accommodated to the nature of the ſubſtance which we eat, and theſe are the *Inciſores* and the *Dentes Canini*; if

the ſubſtance we eat is not hard, but is eaſily penetrated and divided, then the *Inciſores* are capable of making an impreſſion upon it, and for that purpoſe they are firmly fixed in the jaw to break off the part they lay hold on; but if it be more ſolid, and not eaſily penetrated, and that a piece cannot be ſeparated without difficulty from that body, whereof it is a part, then we apply the *Dentes Canini* or eye-teeth to it, which are not ſo broad, nor have ſuch an edge as the *Inciſores*, but are ſharp and pointed like an awl, and ſo do more readily penetrate a hard ſubſtance; and as the parts of a more ſolid body are commonly ſeparated with more difficulty, and as there muſt be a greater ſtreſs put upon thoſe teeth which break it into pieces, ſo theſe teeth, tho' they have but one ſingle root, are much more firmly fixed in the jaws than the *Inciſores:* Beſides, the poſition of all theſe teeth is accommodated to their uſe, as being placed oppoſite to the aperture of the mouth, ſo that they may be conveniently applied to the ſubſtance we are to eat, before it is broken, and when it is too large to be admitted within the mouth; the teeth which by compreſſion and attrition reduce the little morſels to ſmaller parts, are from the manner in which they break the aliment, called *Dentes Molares*, becauſe they grind, like ſo many little mill-ſtones, the food between them; and that they might be rendred fit for this purpoſe, they are made broad at that extremity, which ſtands out of the gums, by which means they retain ſome quantity of the food between them, every time the lower jaw is pulled up and forced againſt the *Maxilla ſuperior*; and as they are broad, ſo they are formed with inequalities and protuberances, and by the motion of the lower jaw from one ſide towards the other, they grind what lies between them into pieces; the poſition of theſe teeth is likewiſe as convenient as that of the *Inciſores* and the *Dentes Canini*; for being deſigned to break the pieces of ſolid food, which are taken into the mouth, and theſe pieces, when compreſſed and moved by the *Dentes Molares*, being apt to fly out of the mouth, if there was no contrivance to prevent it, the *Molares* are placed beyond the aperture of the mouth and oppoſite to the cheeks, keep the food within that cavity; and not only ſo, but preſs it in between the *Dentes Molares* on one ſide, as the tongue does on the other, until they have ſufficiently comminuted and divided it: At the ſame time, whilſt the *Dentes Molares* are breaking the food, there flows into the mouth a ſalival juice, which mixes with it, and not only ſerves to moiſten and render

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it more apt and eaſy to be divided but ſeems to be the ferment, by which the food is diſſolved and digeſted, and therefore it is intimately mixed therewith by the teeth's agitating them together in maſtication; this liquor, which we commonly call the *Saliva* or ſpittle, ſeems to be a compoſition of two ſeveral juices, very different in their natures; and therefore the ſeveral parts of it are ſeparated by their proper glands; nature having planted no fewer than four pair about the mouth, which ſupply the juices that conſtitute the *Saliva*; *viz.* the *Parotides* and the *Glandulæ Nuckianæ*, the *Glandulæ Maxillares internæ* and the *Sub-linguales*; of theſe two juices, Dr. *Havers* takes one of them to be an acid, the other an oleaginous liquor, ſomething like oil of turpentine: For amongſt ſeveral experiments, the following gave the Dr. moſt ſatisfaction: He took a piece of raw fleſh, and having cut it into pieces, but much larger, than what our more ſolid food is reduced to by a due maſtication, he mixed therewith ſome crumbs of bread, then he poured upon them oil of turpentine and upon that oil of vitriol, and ſhaking them together, he digeſted them for four hours in *Balneo Mariæ*, and then ſhaking them again in the glaſs, he found the meat diſſolved, and all become a thickiſh pulp; the Dr. could not but take notice, that oil of camphire, tho' it does not otherwiſe ſeem much different from oil of turpentine, and oil of vitriol, being mixed together produce an effervelcence, as well as oil of turpentine and oil of vitriol, yet did not touch the meat upon which he poured them, ſo as in the leaſt to diſſolve them; the Dr. found, that an acid and a ſolution of ſalt of tartar diſſolved ſome part of the fleſh meat, when mixed with it, but yet neither ſo ſoon nor ſo perfectly, as the two beforementioned oils did; and the Dr. the rather conjectures that one of thoſe juices, which conſtitute the *Saliva*, is more of the nature of oil of turpentine than of a fixed ſalt, becauſe it will correct and temper even oil of vitriol, ſo as to render it more tolerable to the fibres of the ſtomach: The Dr. ſuppoſes, that four of the eight ſalival glands, ſupply one of theſe juices, and the other four the other; and this ſeems to be a very good reaſon why they are ſo diſpoſed and the orifices of their ducts ſo ordered, that the juice ſupplied by one gland, is diſcharged into the mouth very near the orifice, by which the juice of a different nature is tranſmitted from another, ſo that they muſt neceſſarily meet and mix together; thus the *Glandulæ Nuckianæ* and the *Parotides* throw in two different juices by orifices,

which open into the mouth very near to one another, and the *Glandulæ Maxillares internæ* and *Sub-linguales* do below ſupply the ſame kind of juices by orifices, that open ſo near to each other, as to ſecure the mixture of the two different juices: The Dr. aſſerts, that theſe different ſorts of liquors, ſeparated by theſe glands, are of ſuch a nature as to be apt to ferment upon their firſt mixture, but perhaps more conſiderably, when they come to be digeſted by the heat of the ſtomach; ſo that the colluctation or fermentation, which attenuates and concocts the food in the ſtomach, does not ordinarily ariſe between the aliment, and *Saliva*, but between the ſeveral parts of the *Saliva* itſelf; and indeed if the *Saliva* did not conſiſt of two juices, whoſe nature is in ſuch a manner different, as to render them apt to ferment upon their mixture, it would be very hard to conceive, how it ſhould ſerve ſo readily and indifferently for the digeſtion of all eatables, not only of a different, but of a contrary nature; how it ſhould ferment with acids as well as *Alcalies*; digeſt things that are cold as well as hot or temperate, *&c.* the concoction of all which is rationally accounted for, by ſuppoſing that the fermentation, which ſerves for the digeſtion of the food, ariſes from a peculiar difference in the nature of two juices, which conſtitute the *Saliva:* And this ſeems to be as effectual, and a more certain way to attenuate and diſſolve the groſſer parts of our food, than if the fermentation was made only between the *Saliva* and the aliment; beſides, the *Saliva*, upon the mixture of its conſtituent juices, ſeems to diſcover a fermentation, even at thoſe times, when we do not actually eat; for it is always attended with bubbles and a froth, when it has not been at all agitated in the mouth, and many of thoſe bubbles will remain for ſome conſiderable time after we have ſpit it out.

Nature therefore, having appointed the *Saliva* for the digeſtion of the food, has taken care that it ſhall be thrown in upon the aliment on every ſide; thus, the *Glandulæ Nuckianæ*, and the *Parotides*, ſupply with their juices that part of the food which lies on the outſide of the gums, between the cheeks and the teeth, and the *Glandulæ Maxillares internæ & ſub-linguales* beſtow their liquor upon the meat which is within the teeth and gums: Nature has alſo had a regard to the mixture of the two different juices of the *Saliva*, which is neceſſary to its fermentation as is abovementioned, by placing the orifices of the ſalival glands near each other: The *Saliva*, being thus mixed, does, partly as it is agitated with the food by the teeth, and

and ſome other parts of the mouth, partly by its own fluidity, inſinuate itſelf into, and mix with the food, and not only moiſten and ſoften it, but excite the fermentation, which is to diſſolve it; and when the aliment is thus mixed with the *Saliva*, which ſerves to ferment the whole maſs, it is then conveyed into the ſtomach, that great digeſtive veſſel of the body, where it is kept in a digeſtive heat, and the fermentation not only continued but improved; this fermentation in the ſtomach firſt agitates the finer and more ſubtile parts of the food, and puts them into motion, and ſo with the fermentation of its own, and thoſe alimentary parts, which it firſt communicates a motion to, improved by the heat of the ſtomach, the *Saliva* muſt neceſſarily act upon the groſſer parts; for the inteſtine motion, which is excited in the maſs, does not give the particles, which are fermented, the ſame tendency, but what is ſo various and confuſed, that they muſt inevitably ſtrike not only one againſt the other, but againſt thoſe, which are more groſs, ſo as to attenuate them; ſometimes by a colliſion, which ſtrikes off ſmaller particles from the larger parts; ſometimes by a compreſſion, when the particles, which are in motion, happen to ſtrike directly againſt any groſſer part on every ſide of it; and ſometimes by a kind of exploſion: For without doubt, the *Saliva*, which is fluid, inſinuates itſelf into the interſtices of the more groſs parts of the aliment; and whatever is agitated and expanded in thoſe interſtices, requiring a larger ſpace for the freedom of its motion, and offering a violence to every thing that oppoſes its tendency, will, like gun-powder included in a ſhell, force its way out, and tear to pieces that matter which endeavours to confine it; thus the groſſer parts are divided, untill at laſt they are ſo far attenuated, as to mix more equally with the fluid, and with them conſtitute one pulp, or chylous maſs: And altho' the Dr. does not apprehend, how the ſtomach ſhould, by its reciprocal motions in inſpiration and exſpiration, be able to break and attenuate any matter that will not be ſoftened and diſſolved by agitation in a liquid; yet it is certain, that theſe motions cauſed by the diaphragm and abdominal muſcles in reſpiration, make thoſe parts which are broken off, as they are diſſolved, mix more intimately with the liquid; as the meat, he digeſted with oil of turpentine and oil of vitriol did by agitation, mix more equally with them, and became a pulp: It is further probable, that from the mixture of the two juices of the *Saliva* and their fermentation, there reſults ſuch a *tertium quid*, as is

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apt to ferment with the bile; and therefore, when the aliment has been a ſufficient time under the fermentation, excited by the *Saliva*, it is then thrown into the *Duodenum*, where it meets with the bilious juice, which flows into that inteſtine from the liver, from which a new fermentation ſeems to ariſe; and the commotion of the parts of the aliment being ſtill continued, carries on the buſineſs of digeſtion, untill the food is perfectly concocted; tho' it is probable, that this new fermentation ſerves not only for the more perfect digeſtion of the food, but likewiſe for the ſeparation of the chyle from the feculent parts; and the Dr. was confirmed in this opinion, that from the mixture and fermentation of the two juices, which conſtitute the *Saliva*, there reſults a matter which is apt to ferment with the bile, by the following experiment; the bile being generally allowed to have much of a ſaponaceous nature, he made a ſolution of ſoap in fair water, which he mixed with the oils of turpentine and vitriol firſt put together, and from their mixture he obſerved a very eaſy and gentle fermentation, which continued for a conſiderable time.

Obſervations in Weſt-Barbary, *from* Cape Spartel *to* Cape de Geer; *by Mr.* Jezreel Jones. Phil. Tranſ. N° 254. p. 248.

THE *Mauritanian*, or *Barbarian Moor*, when he riſes in the morning, waſhes himſelf all over, and dreſſes; then he goes to their *Jiama*, or church, ſays his prayers and returns home, where his wife, concubine, or ſlave, have his breakfaſt provided for him, which is ſometimes made of barley, or wheat-gruel; it is made ſomething thicker than ours, till it be ropy; they put origanum, and other herbs powdered into it, which for ſuch uſes they keep dried all the year round; ſome put a little pepper, and other ſpices to it: Mr. *Jones* had often been treated in a morning with warm bread, freſh butter, and ſometimes butter and honey; ſome again, give *Cuſcuſoo* with milk, others with fleſh, and others again with roots; when any of them has a gueſt come to his houſe, the neighbours bring their diſh to welcome him, on account of the reſpect and love they bear their neighbour, as well as to ſhew their readineſs to entertain the ſtranger; this practice is found conſtantly uſed amongſt the *Moors* throughout the whole country, reciprocally one towards the other; and Mr. *Jones* as often found the like civility, as he had occaſion to take up his lodgings at any place, where he was acquainted with any of the inhabitants: The *Jews* likewiſe ſhew great civility to any Chriſtian, and treat

treat him with what they have, as ſtewed or baked hens, capons, hard eggs boiled or roaſted, which they preſs flat with pepper and ſalt, wine, brandy, &c. They have generally the beſt bread, and every thing elſe of the kind they can get; they put aniſe, and two or three other ſorts of ſeeds into their bread; one ſort of which is black, and angular, and taſtes almoſt like carrot-ſeeds, and which Mr. *Jones* had ſeen ſometimes uſed in bread in *Spain:* They eſteem honey a wholeſome breakfaſt, and reckon that the moſt delicious, which is in the comb with the young bees therein, before they come out of their caſes, and whilſt they look milk-white; of theſe Mr. *Jones* had often eat, but they ſeemed inſipid to the palate, and ſometimes he found they gave him the heart-burn: In *Suſe*, he had a preſent made him, by a friend, of a bag of honey, as what is greatly eſteemed, and what they preſent to the men of greateſt note amongſt them; and he told Mr. *Jones* that he muſt eat a little of this every morning to the quantity of a walnut; it was thick like *Venice* treacle, and full of ſmall ſeeds; it always made him ſleepy, but he found himſelf well, and in very good plight of body, after taking it; the ſeeds were about the bigneſs of muſtard-ſeed; and according to the deſcription he had of them, and the effects he found by eating them in the honey, they muſt be a large ſort of poppy-ſeed; the honey, wherewith the ſeeds were mixed, was of that ſort, which in *Suſe* they call *Izucanee*, or *Origanum*, on which the bees feed. *Cuſcus* or *Cuskſoo* is the principal diſh amongſt them, as the *Olla* is in *Spain*; it is made of the flour of wheat, and in defect of that, of barley, millet, *Indian* corn, &c. They ſhake ſome flour into an unglazed earthen pan, made on purpoſe, after firſt ſprinkling a little water on the bottom of the pan, then they work it with both their hands, turning them backwards and forwards in order to grain it, till it reſemble *Eaſt-Indian Sago*; they ſtew their fleſh in earthen pots cloſe covered, and put the *Cuskſoo* into a earthen cullender, which they call *Caskaſs*, and this into the mouth of the pot, ſo that all the ſteam ariſing from the meat, is imbibed by the *Cuskſoo*, whereby it ſwells and becomes fit to be eaten; when it is enough, they put the *Cuskſoo* out into a diſh, and heaping it up, they make a place for the meat to lie in, then they put a good deal of ſpices, as ginger, pepper, ſaffron, &c. upon it; this diſh is ſet on a mat upon the ground, about which four men may eaſily ſit, tho' Mr. *Jones* has ſeen ſix or more about one diſh; they ſit with their buttocks upon the calves

calves of their legs, and with the ſoles of their feet upon the ground; but the number of diſhes, is in proportion to the gueſts; they ſometimes uſe this diſh at breakfaſt, as well as at dinner and ſupper, but commonly at the two laſt meals; they cover it with ſomething made on purpoſe in ſhape of an E, and it will keep hot for two hours: At a grand entertainment, they roaſt a whole ſheep, ſometimes a half, or a quarter, upon a wooden ſpit, or ſome ſuch contrivances; they do not keep continually turning it, as we do, but ſuffer one ſide to roaſt ſlowly before they turn the other; the fire is commonly of wood burnt to a clear coal, and made in ſuch a manner that the heat aſcends to the meat; they baſte it with oil, incorporated with a little ſalt and water; they let it thoroughly roaſt, and then they ſay *Biſmillah*, *in the name of God*; and after they have waſhed the right hand, they pull the meat to pieces, and fall to eating; it is to be obſerved, that in eating they only uſe the right hand, and one holds the meat whilſt the other pulls it aſunder, diſtributing the pieces to the reſt, as they are ſeparated; they ſeldom uſe a knife, and a fork is a rare thing amongſt them; they are dexterous at this way of carving, and never flinch at the warmth of the meat, for that would look mean, and might occaſion another more bold to take the office upon him; when they have done, they lick their fingers, and as often as they have a hot diſh, they waſh their hands afreſh; then they have *Alfdouſh* or *Vermizzelli* with ſome meat upon it, ſtewed meat well ſpiced, and ſavory broth; and after they have eat the meat, they dip their bread in the ſauce or broth, and eat it; they are cleanly in their cookery, and if they find a hair, it is a capital crime, but not ſo, as to a fly, becauſe it has wings, and may get in after the meat paſſes from the cook's management: If the meat is well and high ſeaſoned, they do not reckon that a great fault: *Cubbob* is ſmall pieces of mutton, wrapped in the cawl of a ſheep; ſome make good *Cubbob* of the liver, lights and heart, they pepper and ſalt them, and put ſweet herbs and ſaffron to them, then they roaſt them, and when they diſh them up, they ſqueeze an orange or two on them: Thus they commonly uſe in their ſtewed meats lemon and orange for fiſh or roaſt-meat: *Elmoroſia* is pieces of beef, cow or camel, ſtewed with butter, honey and water; ſome mix *Rob* of wine therein, they add ſaffron, garlic or onions with a little ſalt to it, and when it is enough, they ſerve it up; they eſteem this a delicious diſh, which they moſtly uſe in winter, and ſay that it is good againſt colds,

colds, tho' they reckon beef cooler than mutton; they will likewiſe treat you with ſtewed hare, ſtewed and roaſted pullets and partridges, theſe they disjoint, and if they are not fat enough of themſelves, they let them ſtew in water and oil or butter; when they are almoſt enough, they beat a couple of eggs, which they mix with the liquor, together with juice of lemon or vinegar, which they uſually have very good, and then ſerve them up; then you have more baked and roaſted meat and another diſh of ſtewed meat, which is extremely good; they take a leg of mutton, cut off the fleſhy part, leaving out the ſkin and ſinews; this fleſh they mince very fine, as alſo ſome ſuet, parſly, thyme, mint, *&c.* with a knife in each hand, which they hold acroſs, andmanage with great dexterity; then they take pepper, ſalt, and ſaffron beaten together and ſome nutmeg, theſe they add to the reſt, with about half a handful of rice; they cut an onion of the beſt ſort half through, taking off the firſt coat, as not ſo fit for uſe, unleſs it be thick; this coat they fill with forced meat, then the next, and ſo on, which makes them look like ſo many onions, ſome they put up in the beſt vine-leaves; whilſt this is doing, the bones, and what remains of the legs of mutton, being in moderate pieces, are ſtewing with as much water, as will juſt cover them, then they put their forced meat balls a-top of the meat, and over them a green bunch of grapes, and then cover it, and let it boil till it is thoroughly enough; this Mr. *Jones* reckons one of their beſt diſhes, and which they often uſe in *Fez* and other cities: *Pillowe* or *Pilêe* is a diſh very well known, being made with boiled rice, a good pullet, mutton and ſpice; the fleſh and fowl is laid upon the rice in a diſh, as *Cuskſoo*, and ſo ſerved up. Mr. *Jones* eat once of a buſtard, which they roaſt and ſtew (beſides they make an excellent diſh of its guts) which ſeem'd to him very pleaſant and ſavoury and very grateful to the ſtomach; this bird, as likewiſe the hedge-hog, is fit for their king's table; then they have ragouts, made with ſparrows, pigeons, *&c.* Their drink is plain water or milk, and ſometimes *Rob* of wine mixed with water; this liquor is very grateful and pleaſant; it is eſteemed a remedy againſt cold, and they pretend to take it medicinally; for *Rob* of grapes is allowed by their law; under this pretence many *Feſſee* merchants preſs all the grapes in their vineyards to make *Rob* or vinegar, which they put up in great jars under ground, and keep it long till it prove excellent wine: When a number of them, with every one his miſtreſs, appoint to be merry, they

retire to their vineyard, or garden, where they have muſic, and all or moſt of the above diſhes, and there ſit and carouſe over a great earthen bowl of wine, of about four or five gallons, drinking round out of a cup that will hold near a pint, and they rarely part till they have made an end of the whole jar, which is ſeldom leſs than a week's time; ſuch as are known to drink wine, or piſs ſtanding, their teſtimony is invalid in law: In a morning, during this time of merriment, they are for ſome ſavoury bit, as pickled fiſh, or *Eſcaveche*, or *Elchole*; they are great lovers of fiſh, which they have in great variety, and very good; they fry them in origan oil, and they alſo ſtew, roaſt, and bake them with a great deal of ſpice, onions, garlick, cummin, parſley, and coriander: The *Eſcaveche*, or fried fiſh, is cut into thin ſlices, and put into vinegar, with the above ſpices, adding ſaffron and pepper, *&c.* it will keep above a month, and it is very common amongſt them, as alſo pickled limes, olives, capers, *&c.* They eat parched *Garavanças*, parched almonds, and beans, which they parch in a pan with water and ſalt; theſe, and other things, they have to reliſh a glaſs of wine, and whet them for a freſh carouſal: The hedge-hog is a princely diſh amongſt them; before they kill it, they rub his back againſt the ground, by holding his feet betwixt two, as men do a ſaw, till it has done ſqueaking, then they cut its throat, and with a knife cut off all its briſtles, and ſinge it; they take out the guts, ſtuff the body with ſome rice, ſweet herbs, *Garavanças*, ſpice, and onions; they put ſome butter and *Garavanças* into the water, where they let it ſtew in a little pot cloſe ſtopped, till it is enough, and it proves an excellent diſh: The *Moors* do not care to kill lamb, veal, or kid, ſaying it is a pity to part the ſuckling from its dam; with their boiled meat they often eat carrots, turnips of two or three ſorts, cabbage, beans, and peaſe, *&c.* of which they have plenty, and thoſe very good; Mr. *Jones* eat porcupine ſtewed, which reſembled camel's fleſh in taſte, and that is the neareſt to beef of any thing he knew: *Alchollea* is made of beef, mutton, or camel's fleſh, but chiefly of beef, which they cut into long ſlices, ſalt it well in jars, and let it lie 24 hours in the pickle; then they remove it out of thoſe tubs, or jars, into others with water, and when it has lain there a night, they take it out, and put it on ropes to dry in the ſun and air; when it is thoroughly dried and hard, they cut it into pieces two or three inches long, and throw it into a pan or cauldron ſufficient to hold it, with boiling oil and ſuet, where it boils till it is very clear, and red when cut, then they take it out, and ſet it to drain;

drain; when all this is done, it ſtands till it cools, and jars being prepared to put it up in, they pour upon it the liquor in which it was fried, and when it is thoroughly cold, they ſtop it up cloſe; it will keep for two years, will alſo become hard, and the hardeſt they look on as the beſt done; this they diſh up cold, ſometimes fried with eggs and garlick, ſometimes ſtewed, with lemon ſqueezed on it; it is very good either hot or cold.

Their travelling proviſions are bread, almonds, raiſins, figs, hard eggs, cold fowl, &c. but what is moſt uſed by travellers is *Zumeet*, *Tumeet*, or flour of parched barley for *Limereece*, which, not being *Arabian*, but *Shilha* names, made Mr. *Jones* take it to be of a longer ſtanding than the *Mahometans* in that part of *Africa*; they are all three made of parched barley flour, which they carry in a leathern ſatchel; *Zumeet* is the flour mixed with honey, butter, and ſpice; *Tumeet* is the ſame flour done up with origan oil; and *Limereece* is the flour only mixed with water, and ſo drank; this quenches thirſt much better than water alone, ſatisfies a hungry appetite, and cools and refreſhes the traveller, getting the better of thoſe ill effects a hot ſun and a fatiguing journey might occaſion; the mountaineers of *Suſe* uſe this for their diet, at home as well as on a journey: It is lawful for them to eat all they take in hawking, hunting, and fowling, if they take it before it be dead, ſo as to have time to cut its throat, and ſay *Biſmillah*; or if a man is known to be expert at the game, and ſays thoſe words, before he lets the hawk take its flight, lets go the grey-hound, or fires his gun, it is lawful; except ſwine's fleſh, and what dies of itſelf, they are at liberty to eat or ſell whatever they catch; they pretend that there is but one part about the hog that is unlawful, and which they do not know, and for that reaſon are obliged to abſtain from the whole; they eat ſnails boiled with ſalt, and cry up their wholeſomeneſs; it is lawful for them to eat fiſh of all ſorts; moſt of their food in *Taffilet* and *Darha* is dates, of which there are ten or a dozen ſorts; they have good capons all over the country; they have no turkeys, ducks, nor geeſe, but what are wild, and thoſe of two ſorts; duck, teal, and mallard are good eating, as alſo curlews, plovers, ſnipes, oxbirds, pipers, and a ſort of black crow with a bald pate, and long crooked bill; *Antilopes*, killed in hunting, prove very good food; they are as large as a goat, of a cheſnut-colour, and white under the belly; their horns are almoſt quite ſtreight from the head upwards, and gradually tapering, with rings at a diſtance from each other, till within an inch and a half of the tip; they have fine large black eyes, a long and

ſlender neck, feet, legs, and body ſhaped ſomewhat like a deer; they have two cavities between their legs, the male he ſuppoſes, as well as the female; they are gregarious, or form themſelves into herds, and they have ſcouts to give them notice of any approaching foe; when two of them lie down together, they lay themſelves back to back, and the head of one towards the tail of the other, that they may ſee every way; their dung is ſweet and pleaſant enough; they are taken ſometimes by the hawk, and ſometimes are ſhot; they are too ſwift for a greyhound: Partridges in *Suſe* commonly rooſt on trees, foxes being ſo numerous that they would otherwiſe deſtroy them; the *Moors* eat foxes if they are fat, either ſtewed or roaſted, but they do not care for them lean; which has occaſioned a proverb amongſt them, to wit, *hellel deeb*, *harom deeb*; *a fox is lawful, and a fox is unlawful*, i. e. when fat it is lawful, but when lean, it is unlawful: They have fruits and ſweetmeats of ſeveral kinds; as three or four ſorts of pumpkins, macaroons, almonds, prepared ſeveral ways, raiſins, dates, figs, both dry and green, two or three ſorts of excellent melons, water-melons, pomegranates of ſeveral kinds, apples, pears, apricocs, peaches, white and black mulberries, plumbs, damaſcens and cherries, grapes of ſeveral kinds, and very good: Mr. *Jones* had ſeen grapes in *Meſſa*, Lat. 30°, or thereabouts, as big as a pigeon's egg, but they do not make wine: If the *Moors* would but aſſiſt nature, they might have every thing in perfection; for ſalads, they have lettice, endive, carduus, parſley, apium, and other ſweet herbs, onions, cucumbers of ſeveral kinds, ſome about a yard long, and two or three inches thick, and hairy, which is reckoned the wholeſomeſt ſort; radiſhes, fumatas, or apples of love, all which they cut, uſing oil, vinegar, and ſalt, with ſome red pepper to them; they eat this ſallad with bread; they have a fruit called *Baranêên*, in *Spain Baragenas*, which they ſtew with their victuals; ſometimes they cut them into thin ſlices, and fry them; it makes a pretty diſh; when the *Moors* have feaſted, every one waſhes his hands, and mouth, gives thanks to God, and bleſſes the hoſt who gave the entertainment; after this they chat a little, or tell ſome ſtory, and then lie down to reſt.

The Antiquity of the Numeral Characters; *by Mr.* Tho. Luffkin. Phil. Tranſ. N° 255. p. 287.

DR. *Wallis* not being able to trace the uſe of the numeral characters here in *England*, higher up than the year 1133, Mr. *Luffkin* does here produce an inſtance of their being older than

than that date by 43 years; for over-againſt the market-place in *Colcheſter* ſtands a houſe, whoſe back part is an ancient *Roman* building, but the front is of a later date, and built of timber; upon the bottom ſill (which is almoſt in the form of a triangular priſm) of one of the windows of the front, between two carved lions, ſtands an eſcutcheon, containing only thoſe figures 1090.

That Herbs of the ſame Make and Claſs have generally the like Virtues; *by Mr.* Ja. Petiver. Phil. Tranſ. N° 255. p. 289.

THAT plants of the ſame figure or likeneſs have generally much the ſame virtues and uſe, will not be thought an improbable conjecture, eſpecially when we conſider, that the organs and ſtructure of all plants of the ſame family, or claſs, muſt have much the ſame veſſels and ducts to compleat their regular formation, and conſequently the juices circulated, and ſtrained thro' them, cannot be very heterogeneous; and as for the moſt part their ſcent and taſte have a great affinity, ſo of courſe their virtues likewiſe cannot be very different. 1. And to inſtance in the tribe of umbelliferous herbs; it is the property of thoſe to have the poſition of their flower-branches in ſuch a manner as to proceed from one baſis or center, from which they expand themſelves into an *Umbella* or tuft, whoſe flowers conſiſt of five irregular, or rather unequal (that is differing in ſhape and bigneſs) pentapetalous leaves, whence their ſeed is produced, which are naked and double, or by their ſplitting ſeem to be ſo; this kind Mr. *Petiver* obſerved to be endowed with a carminative taſte and ſmell; they are powerful expellers of wind, and therefore are good in all flatulant diſorders, and of great uſe in the cholick, *&c.* as aniſe, caraway, cummin, angelica, ſmallage, parſly, lovage, *&c.* the greateſt virtues of theſe plants lies in the ſeed, next in the roots, and in the leaves of ſome few of them. 2. The *Plantiçæ Galeatæ* and *Vertillatæ* are a ſpecies of plants that bear their flowers in rundles or whorles, at greater or leſs diſtances round the ſtalk, whoſe monopetalous flowers (if we may ſo call them, being ſuch at the bottom) being tubulous, and different from the laſt mentioned, are generally divided into five unequal ſegments, as the umbelliferous; but with this diſtinction, that the two greater *Petala* or flower-leaves in this tribe are ſometimes above, and at other times below; whereas the others are conſtantly the ſame, that is always lie in the ſame place, being expanded on a flat or plane ſurface; the flowers of verticillated plants, are from the different poſition of their *Petala*, diſtinguiſhed into *Flores Galeatiæ* and *Labiatiæ*; the

Calyx

Calyx or case to the lower or tubulous part of each flower serves also for its seed-vessel; in the bottom of which is contained, in all Mr. *Petiver* observed, four seeds set close together upon a plane, which drop out, when ripe, the husk being always open, and commonly divided into five points, which answer the segments of each flower: The virtue of these last chiefly consists in the leaves and husks, rather than in the flowers; Mr. *Petiver*'s reasons for giving the preference, contrary to all authors, to the husks of this tribe, before the flowers, are, because he commonly observed that the *Calyces* are the chiefest, if not the only part of the plant, on which he found its viscous or sulphureous particles adhere; and this may be very easily perceived, not only by its much stronger and more penetrating smell, but by its clammines far beyond the other parts, as is very apparent, particularly in the husks of sage and clary; and if you distil these with spirits of wine, you will find it much stronger, than what is distilled from a greater quantity of flowers only; for these, consisting of finer and more volatile particles, are capable of retaining only what the vicinity of the stronger and thicker contexture of the *Calyces*, can easily communicate to them: Mr. *Petiver* supposes that the greatest part of this tribe is a degree warmer than the last; and consequently that their heat approaches nearer to the nature of *Aromatics* than *Carminatives*; and that their effects are more peculiarly adapted to such nervous diseases, as are more intense, and to which the *Umbelliferæ* cannot so quickly reach, *viz.* in apoplexies, epilepsies, palsies, *&c.* in which cases lavender, rosemary, stœchas and some others, are simples which all our ancient physicians have very much commended in these stubborn diseases; as also mint, baulm, penny-royal, savory, thyme, hyssop, marjoram, basil, origan, dittany of *Crete*, *Marum* or common mastic-thyme, with *Marum syriacum* and some others; three herbs which have a tetra-petalous regular flower, *i. e.* four equal *Petala* in each flower, are, in relation to their seed-vessels, subdivided under two heads, *viz. Siliquosæ* and *Capsulatæ*, being such as have their seeds contained in long or short receptacles, as pods or *Capsules*: The known herbs of this genus, that are most commonly used in physic, are, mustard, rape, rocket, jack of the hedge, *Paronychia* or whitlow-grass, flix-weed, hedge-mustard, nose-smart, scurvy-grass of both sorts, with some others: The most essential virtues and uses of the herbs of this class Mr. *Petiver* observed was more particularly in the leaves and seed, and next to these

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in the roots, and if any parts are disregarded, these are the flowers and pods: The leaves are more particularly used in the water and garden-cresses, sea and garden scurvy-grass, hedge-mustard, iberis or sciatica-cresses, lepidium, pepperwort, cardamum, shepherd's purse, *&c.* to which may be added our cabbage, cole-worts, savoys, sprouts, which are also of this tribe; and tho' they are of no great reputation in physic, yet for some ages past they are greatly esteemed in the kitchin: Others of this family that are more peculiarly eminent for the virtues contained in their seed are the common mustard and rape, the *Thlapsi Dioscorides* or treacle-mustard, the *eruca* or rocket, and *Sophia Chirurgorum* or flix weed; the seed of which last, Mr. *Petiver* was informed had some years past been used with very good success by several people in the north of *England* for the stone and gravel. The roots which have gained considerable reputation not only in diet but also in physic are both garden and *Spanish* radishes (which is the large black rooted sort) as also the wild or horse radish, to which must be added the round and long-rooted turnep: Most of this tribe Mr. *Petiver* found tho' they are very hot like the two last, *viz.* the *Umbelliferæ* and *Verticillatæ*, yet they exert their virtues in a much different manner; to wit, by a diuretic volatile salt, and are found most effectual in chronic diseases, as the scurvy, dropsy, gout, jaundice and other ill habits of the body, where the blood is vitiated, rather in its particles than in its motion; carrying off its impurity by a diuretic *Discrasis*, or discharge of the noxious heterogeneous salts contained therein; and consequently by purification disposing it to a better and more sanative temperament; several of these herbs as water-cresses, garden and sea-scurvy-grass with mustard-seed and garden and horse-radish, which are all of this tribe, are by most if not all physicians, as well ancient as modern, allowed to be extraordinary diuretic and anti-scorbutics.

Medical Observations in the Northern Countries; *by* Dr. Philip Lloyd. Phil. Trans. N° 256. p. 310. *Translated from the* Latin.

HOT baths are used no where so much as in *Lithuania*; where, when the patient has sweated plentifully, they either cup him, or whip his back with rods, till it becomes pretty red: In the same manner, when any among the *Cossocks* is very bad, he goes to a bath, where his body is covered with some particular herbs, and in order to raise a blister they apply a hot-

a hollow horn to the part affected upon the breaking of which, there runs out a thin watry humour, very often of different colours, as yellow, green and black, upon which the patient recovers; that variety of colours may be owing to the herbs wherewith the patient is covered, or to the horn itself, which is tinged with some colour; to provoke sweat the *Cossacks* chiefly use *Aqua Vitæ* or some acid broths with oil and pepper, and in their diet they do not forbear eating flesh with vinegar and boiled onions, which they call *Bigost*; as on the one hand these people do not much regard pharmaceutical remedies, so on the other, they go to excess in using some chirurgical operations, as bleeding by lancets and leeches, which latter they also apply internally on the palate and gums; they also use issues, and the trepan, which last operation is very frequent in *Sweedland*, and executed with success; the *Muscovites* that border upon *China* use tea not only in decoctions, but also in substance, and powdered in *Aqua Vitæ* to the quantity of a drachm and a half: They have a sort of odoriferous pastils of a yellow colour, of which they snuff up four grains with their mouths open; and for two hours they evacuate more viscid *Mucus* than they could with any cathartic, and by these they cure all disorders of the head proceeding from cold: Some of them swallow down the smoak of tobacco out of a very large pipe; upon which they drop down, as in an apoplectic fit, out of which they are soon rouzed by vomiting and purging, and tho' no such effects ensue, yet when they awake they find their heads relieved, and themselves in a good plight: The *Tartars* are for the most part from their childhood accustomed to live on milk and horse-flesh, and their physic is continual riding; besides some external empyrical medicines, they have a few internal ones among them; as for instance, when any one is very much indisposed, and when they suspect a malignant fever, they take a young hare and opening the carotid artery, the patient sucks the blood as long as he can; afterwards they flea the skin, and wrap it warm about his head, and so composes himself for sleep and sweat: When any of their slaves or captives is taken ill of a fever, they drag him for some time by the hair, and afterwards throw him into a running stream, and thus by altering the humours and spirits, the patient gets clear of the fever: The Dr. had these accounts from a friend, who had lived for a long time in these northern parts; if any among the *Tartars* should meet with a disaster either by falling from his horse, or otherwise, they first of all cause him to make water,

water, and after opening a vein, they give him in his drink the burnt bones of a horſe, or a certain kind of *Bolus*, in which that country abounds: Sour mares milk among them, is an univerſal cooler in all hot diſtempers, nay it is a ſtomachic balſam in the ſmall pox: The *Muſcovites* uſe cupping with ſcarrifications on the buttocks inſtead of bleeding, and ſometimes they apply leeches; they make emulſions of turnep-ſeed, wherein they put *Album Græcum*. The *Poles* have a certain kind of nouriſhing medicine much uſed among them, called *Barſt*, which being a gentle acid, reſtores the ferment of the ſtomach, and is very beneficial in ſurfeits; this kind of medicine they make up of *Branca Urſina* or of fine wheat bread fermented, in form of a decoction of herbs. Moreover when any one begins to ail, and complains of a great pain in the head, of the gripes, or wandering gout, *&c.* they preſently apprehend a *Plica* or *Koltum*, and to cure it they uſe a lotion made of *Branca Urſina* and other herbs, or at leaſt a mixture of wine and oil, in which they frequently bathe the head; and the *Plica* being thus cured in the head, the diſtemper ſeems to abate, and the morbific matter being thus critically removed, the whole cure is left to nature; which plainly ſhews that this diſtemper proceeds from a cauſe quite different from that of neglecting to comb the hair: If any one attempts to tear the hair by combing it, or to cut it, he brings upon himſelf another diſtemper, and very often upon cutting the hair the blood runs out as from the ſmall branches of a vein, which is not to be wondered at, ſince the hair is formed of the ramifications of arteries, veins, and nerves, that are included and afterwards extended in a *Capſula* or caſe; as appears by *Autopſy*, and by a microſcope in the hairs of the beard of a cat and other animals.

What authors have ſaid concerning the cauſe of the *Plica*, is either too general, or imperfect and unſatisfactory; the internal cauſe may be owing to the ſubcutaneous glands; ſo that where their ſeveral ducts and pores meet, there the hairs that grow pretty thick and in a narrow compaſs, are, from a too viſcid juice proceeding from theſe glands, matted together; but ſeeing ſuch a cauſe may be found elſewhere, it cannot alone account for an epidemical diſtemper: Wherefore the adequate cauſe is to be ſought for, partly from a contagion, and partly from the improper uſe of the non-naturals: There is no doubt to be made of a contagion in the caſe, ſince it is uſual for travellers to carry their beds about with them; the exceeding chill of that country air abounds in a coagulating acid, whence the perſpiration of that glutinous matter which ſticks about the roots of the hair is eaſily

impeded, but especially whilst the *Poles* go bare-headed, as they frequently do; the patients in this distemper have a fancy to some particular thing; some desire water only, others burnt spirits, with an aversion to all other sorts of drink; by the like medicines they are relieved in the scurvy. Besides the malignant fever called the *Hungarian* fever, there are other epidemical distempers of less note, as *Czemer*, *porcellus Cassovienſis*, & *Strumæ*; *Czemer* is a certain kind of swelling on the side of the wrist upon the arteries, resembling a soft knot, which upon touching, causes a pain; it is cured by emetics and sudorifics; the *Porcellus Cassovienſis* is a hard tumour, in the shape of a pig, on the region of the spleen, and very frequent amongst the citizens of *Cassovia*, being a schirrous disposition of the spleen with *Flatus*'s in the *Colon*; this distemper is cured by aperitives: *Strumæ* or scrophulous tumours are only to be found in those towns of *Hungary* that border on mountains, where there are gold mines, and they are caused by mercurial waters, and other mineral effluvia; at the decrease of the moon, and in the beginning of this distemper, the patient receives into his mouth the smoak of a burnt sponge, and usually swallows down the remainder of the ashes mixed with honey; but there is no curing of inveterate *Strumæ*.

An Account of Coffee, *by Mr.* James Houghton. Phil. Tranſ. N° 256. p. 311.

MR. *Houghton* could not learn the use of any part of the coffee-shrub, except the berries, which being boiled in water are drank much amongst the *Arabians* and *Turks*, and is also used now amongst most *Europeans*: It is not easy to account how the *Arabians* first came to use coffee, perhaps it was their *Succedaneum* to wine, which *Mahomet* prohibited by his law; nor how they came to roast it before it is infused, which probably was owing to chance, or perhaps to a debauched palate: However it got head, for by its actual heat it is found to refresh the weary, and have several other good effects, like wine that acts by a potential heat. It had not been in use (according to Mr. *Tavernier*) much above 20 years; however it quickly became general, which occasioned its becoming a trade in great towns, where public coffee-houses were set up, into which strangers coming, they learned the custom there, and carried it into their own countries: One Mr. *Rastal* an *English* merchant, whom Mr. *Houghton* knew, founded a coffee-house at *Leghorn* in 1651; the next year Mr. *Daniel Edwards* a merchant from *Smyrna* where coffee had been used time out of mind, brought over

over with him into *England* a *Greek* ſervant called *Paſqua*, to make his coffee, ſo that it is likely this merchant was the firſt that uſed it here, (altho' Mr. *Houghton* was informed that the famous Dr. *Harvey* frequently uſed it) as his ſervant *Paſqua*, whom he ſet up, having got a ſhed in the church-yard of St. *Michael's Cornhill*, was the firſt coffee-man.

The beſt coffee-berries are thoſe that are large and plump, with a greeniſh caſt, and tranſparent on the thin parts; the other ſort has a yellowiſh caſt, and is more opaque, but when they are roaſted, it is hard to diſtinguiſh them: Mr. *Houghton* put ſome berries into a glaſs of water to ſee if they would ſhoot, but there was no appearance in a week's time, altho' they were tolerably ſwelled and looked white and bright; he made alſo a decoction of them, which made them ſhoot: The common way of preparing the berries for coffee, is roaſting them in a tin cylindrical box full of holes, thro' the middle of which runs a ſpit, under this is a ſemi-circular hearth, wherein is made a large charcoal fire; by the help of a jack, the ſpit turns quick and ſo it roaſts, being now and then taken up and ſhaked; when the oil riſes and the berries are grown of a dark-brown colour, they are emptied into two receivers, made with large hoops, whoſe bottoms are iron plates, that ſhut into them, where the coffee is well ſhaked and left till it is almoſt cold; and if it looks bright, oily and ſhining, it is a ſign it is well done; if an ounce of this, when freſh, is ground and boiled in ſomething more than a quart of water, till it be fully impregnated with the fine particles of the coffee, and the reſt grown ſo ponderous as to ſubſide and leave the liquor clear and of a reddiſh colour, it will make about a quart of very good coffee: The beſt way of keeping the berries when roaſted is in ſome warm place, where it may not imbibe any moiſture, which palls it and takes off the briſkneſs of its taſte; it is beſt to grind it, as it is to be uſed, except it be rammed into a tin-pot, well covered and kept dry, and then Mr. *Houghton* ſuppoſes it will keep good a month; there ſwims upon the coffee an oil, which the great coffee-drinkers among the *Turks* take in great plenty if they can get it; when the coffee has ſtood ſome time to cool, the groſs parts ſubſide, the briſkneſs is gone, it grows flat and almoſt clear again: Mr. *Houghton* ſent to the chymiſts one pound of clean coffee, one pound of huſked beans and one pound of picked wheat, and he received back,

	Coffee			Horſe-beans				Wheat			
	oz.	*dr.*	℈	*oz.*	*dr.*	℈	*gr.*	*oz.*	*dr.*	℈	*gr.*
Neat Spirit	VI	VI	O	VI	I	O	XII	VIII	II	I	O
Oil	II	IV	II	I	III	O	X	I	O	O	VI
Cap. Mort.	V	III	O	V	III	O	O	IV	VI	O	O

By this account it appears, that coffee yields by diſtillation in a retort almoſt double as much oil as beans, and almoſt treble as much as wheat: The oils are very thick, but both they and the ſpirits have a bad ſavour, as is uſual in burnt materials; by ſpirit is meant the phlegm; the *Capita Mortua* have no ſmell; they were calcined over and over with all the chymiſt's art; but he could not reduce them to a *Calx* or aſhes, and therefore concluded there was no ſalt to be extracted from them: From what has been mentioned above, Mr. *Houghton* obſerves, that little good can be expected from any part of the common drink called coffee, but from its oil, becauſe its other ſubtile parts are evaporated and its groſs parts ſubſide; but he ſuppoſes the oil is nutritive, conſidered as an oil, and warm, conſidered as a chemical oil; for here all the warm parts are collected as in a point, whereby it may enliven and invigorate ſome heavy parts in the fermentative juices and nouriſh weak internal parts, as other chemical oils do when rubbed on the external parts; but being dilated, as it uſually is, he queſtions whether it does any more good than hot tea, broth, or any thing elſe that is actually hot; for he ſuppoſes, that actual and potential heat are much of the ſame operation: Coffee has generally been reckoned to be an *Anti-hypnotic*, or hinderer of ſleep, according to the opinion of Dr. *Wallis* and others; but now it is come into ſuch frequent uſe, the contrary is often obſerved, altho' perhaps cuſtom, as it does with opium, alters its natural qualities: As to the political uſes of coffee, our three kingdoms ſpend about 100 tun a year, whereof *England* ſpends 70; which at 14 pounds a tun (a middling price now a-days) will amount to 20586 *l.* ſterling; and if it were to be all ſold in coffee-houſes it would amount to treble that ſum or to 61740 pounds, which at 10 pounds a-head, will find employment for 9174 perſons, altho' he ſuppoſes that all the people of *England* one with another, do not ſpend five pounds each: Coffee when roaſted, loſes about a fourth part, and then there is ſpent about 52 tun and a half of roaſted coffee, which makes 117600 pound, or 15252800 drachms, which, if there are eight millions of people, is not two drachms, or half a pint of coffee to each in a year; beſides what we uſe, there is a great deal ſent abroad, the gain of which

which will in a ſhort time pay the firſt coſt of what is ſpent at home, which is one of the beſt ways to make an advantage of any foreign trade: Beſides, coffee greatly increaſes the trade of tobacco, pipes, earthen diſhes, tin-wares, news-papers, coals, candles, ſugar, tea, chocolate, &c. Coffee-houſes makes all ſorts of people ſociable, they improve arts and merchandize and all other knowledge very much.

An Hydrocephalus; *by Mr.* John Friend. Phil. Tranſ. N° 256. p. 318.

THE external dimenſions of this head, before it was opened, were as follow; *viz.* from the eye-brows over the crown to the nape 23 inches; the circumference from the nape round the *Oſſa Bregmatis* 26; but round the *Os Frontis* 24; from ear to ear over the crown 19; from the eye-brows to the chin 4; from one extremity of the eye-brows to the other $4\frac{1}{2}$; from the chin to the coronal ſuture $7\frac{1}{2}$; the circumference from the chin round the crown 30; from one extremity of the ear backwards to the other round the noſe 12, and round the nape $6\frac{1}{2}$; from temple to temple over the forehead 11; the circumference of the head round the *Os Frontis* and *Occipitis* 29; the circumference of the neck $9\frac{2}{3}$; the length of the neck 2, the length of the body 33; the circumference of the *Thorax* 18; the length of the foot $4\frac{1}{2}$; from the end of the middle finger to the *Acromion* $12\frac{1}{2}$; the circumference of the arm 5; of the calf $5\frac{1}{2}$; and of the thigh eight inches.

After the integuments were removed, the top of the *Cranium* appeared ſoft and membranous; the extent of the membrane from one temple to the other was 8 inches; between the parietal bones $3\frac{1}{2}$; from the *Os Frontis* to the *Os Occipitis* 12; in the middle, juſt upon the crown, lay a bone (in ſome places a little cartilaginous) 5 inches long and 1 broad, joined to the membranes on every ſide of the ſame thickneſs with the reſt of the upper part of the *Cranium*, that was bony, which was extremely thin every where, and the *Laminæ* lay ſo cloſe, that in many places no *Diploe* could be diſcerned; the membrane was as thin as the *Pericranium*, which yet was eaſily divided from it; none of the ſutures were entirely cloſed; thoſe of the upper jaw were very looſe; in the temporal and lambdoidal ſutures there was a vaſt number of the *Triquetra Wormiana*, all which had ſo many diſtinct ſutures: Upon piercing the *Dura Mater*, a great quantity of water guſhed out, which lay in the ventricles of the brain, as well as between the *Dura Mater* and the *Pia*; the liquor

liquor was thin pale and insipid, of which there was taken out 5 quarts; the *Dura Mater* was firm and entire, of its usual thickness, and it stuck very close to the bony as well as membranous parts of the *Cranium*; all its processes and sinus's were singular; the fourth sinus somewhat larger than ordinary; a very large vein of the *Dura Mater* enter'd the longitudinal *Sinus*, directly forwards towards the *Crista Galli*, contrary to the course of the blood; the *Pia Mater* was very much distended, and seemed to be stretched as much as it could bear; it lay smooth and equal upon the surface of the brain, there being neither any circumvolutions in the brain for it to go between, nor any partition to the *Corpus callosum*, tho' there was a large *Falx* in the *Dura Mater*; the lateral venticles were very thin, their upper part towards the *Cerebellum* was quite wasted, so that nothing was left to cover the cavity in that place but the *Pia Mater*; this was so thin, that in bending down the head to empty the water, it broke and hindered the knowing exactly, how much water the lateral venticles contained; but by their cavity which was very large, one might guess they held at least a pint each; the third and fourth venticles had a little water in them, but were scarcely larger than usual, as *Steno* observed in his hydrocephalous calf; the brain had all its parts plain and entire, tho' its substance in most places was but very thin and loose; about the *Corpora striata thalami nervorum opticorum* it was tolerably thick and firm enough, tho' nothing to what it is in a natural state; the *Cerebrum* and *Cerebellum*, when laid out in their proper position, were 11 inches long; the *Cerebrum* cross the lateral ventricles, was nine inches broad; after all the water was taken out, both of them weighed 1 ½ *lb.* The *Corpora striata & thalami nervorum opticorum* were very small in all their dimensions; on the inside towards the ventricles they were wrinkled, and lay in folds, like those in the inner coat of the stomach; in the *Corpora striata* there were no *Striæ* discernible; the *Plexus Choroides* was very small, the *Glandula Pinealis* was somewhat larger, but less compact than ordinary; the *Nates* were very red and large; two inches long, one broad, and one thick; the *Testes* were not distinguished from them by any protuberance; they seemed rather to be a production, into which the *Nates* lessened by degrees, like a sugar-loaf; the *Cerebellum* was very firm every where, and did not much exceed its natural bulk; the medullary trunk which sends out those little branches like trees, was thicker and harder than usual; the branches were not so much disposed like those of a tree, but went rather

ther in ſingle oblique lines, like ſo many rays from a point; the nerves were all regular and plain, only the olfactory were very ſmall; the optic nerves did not join before they entred the orbits; the *Rete mirabile* was very large, and ſo was Dr. *Ridley*'s circular *Sinus*; on the right ſide were two carotid arteries, the intercoſtal nerve lying between them, and they entered the ſcull at the ſame hole; the trunk of the vertebral, where thoſe arteries unite, was extremely large, and full of blood; the veins were neither larger nor more in number than uſual; Mr. *Friend* could eaſily diſcern three or four lymphatics upon the brain, over the lateral ventricles, but they were too ſmall too be traced: Whether this great effuſion of water was cauſed by an obſtruction in the capillary arteries (which might make the finer part of the *Serum* ouze thro' their coats) or by a rupture in the lymphatics, Mr. *Friend* could not determine.

The mother of the child brought it to *Oxford*, for a ſhew; the account ſhe gave of it was, that ſhe had been three weeks in travail, and that at laſt ſhe was obliged to have the *Vagina* ript for its paſſage; the child was two years and ſix weeks old, it could ſpeak a little, it could neither walk, nor hold up its head, it was always merry, never ſubject to drowſineſs, pain in the head, want of appetite, or indigeſtion; its ſight was ſomewhat dim, and its ſmelling but indifferent; it never had any illneſs, only two or three days before it died, it was very much troubled with the gripes, and upon opening the *Abdomen*, the guts were found extremely ſwelled with wind; every thing elſe in both the lower cavities was in its natural ſtate. By comparing thoſe two *Hydrocephali*, which *Tulpius* gives an account of, with this, we may ſee how different each of them is from it; his firſt was a boy five years old, the ſcull no larger than a man's, and contained only five pints of water; the brain had loſt all its ſhape, and moſt of its ſubſtance, the relicks of which ſtuck to the ſcull; and all he ſays of the ſecond is, that it had a quart of water in one of the lateral ventricles.

Cures *performed by Mr.* Greatrix *the Stroaker.* Phil. Tranſ. N°. 256. p. 332.

A Lad of about 14 years of age, was ſiezed with a violent pain in his head and back; Mr. *Greatrix* ordered him to ſtrip to his ſhirt, and he preſently removed the pain in his head, by only ſtroaking it with his hands; he fell to rub his back, which he moſt complained of, but the pain immediately fled from his hand to his right thigh; then he purſued it with his hand

hand to his knee, from thence to his leg, ancle and foot, and at laſt to his great toe; it made him roar out; but upon rubbing it there, it was quite gone, and it never troubled him afterwards, but in about three weeks time he got the ſmall-pox. Mrs. *D*——— when a girl was ſeized with a great pain and weakneſs in her knees, which occaſiond a white ſwelling; ſhe was troubled with it for ſix or ſeven years, and having in that time uſed divers means to no purpoſe, Mr. *Greatrix* ſtroaked both her knees and gave her preſent eaſe, the pain flying downwards from his hand, 'till he drove it out of her toes, and the ſwelling was gone in a ſhort time, and never troubled her afterwards: A gentlewoman being, after a fever, much troubled with a pain in her ears, and being very deaf, Mr. *Greatrix* put ſome of his ſpittle into into her ears, and turning his finger in them, he rubbed and chaffed them well, which cured her both of the pain and deafneſs: Mr. *Charles L*———*n* was cured of the ſame malady, having very much loſt his hearing; till Mr. *Greatrix* by ſtroaking reſtored it: Mrs. *S*———*n* being extremely troubled, when a child, with the king's-evil, was ſent to *London* to be ſtroaked in King *Charles* the II. time, but was nothing the better, yet Mr. *Greatrix* perfectly cured her: One *Pierſon* a ſmith had two daughters extremely troubled with the king's-evil, the one in the thigh, and the other in the arm, Mr. *Greatrix* cured them both; one of them was healthy ever after, was the mother of ſeveral children, and never had any ſymptoms of it afterwards.

Where Mr. *Greatrix* ſtroaked for pains, he uſed nothing but his dry hand; in ulcers and running ſores he uſed ſpittle on his hand and finger; and for the evil, if they came to him before it was broke, he ſtroaked it, and ordered to apply a poulteſs of boiled turneps every day, till it grew ripe for launcing; then he launced it, and with his fingers ſqueezed out the cores and corruption, and in a few days it would be well with only ſtroaking it every morning; but if the evil was broke before the patient came to him, he only ſqueezed out the cores and healed it by ſtroaking: Such as were troubled with fits of the mother, he would preſently take off the fit, by only laying his glove on their head, but never cured the diſtemper thoroughly, for the fits would return; he cured many of the falling ſickneſs, provided he could ſee them in 3 or 4 fits, elſe he could not cure them.

An

An Experiment of the Rarefaction *of the* Air; *by Mr.* Lowthorp. Phil. Tranſ. N° 257. p. 339.

PLATE XI. Fig. 2. Mr. *Lowthorp* took a cylinder of caſt-braſs ABCD, and cut one end CD perpendicular to the axis *acx*, the other end AB inclined to it at an angle of about 27 deg. 30 min. and therefore the perpendicular to this inclining plane *pc*, and the axis *acx* comprehended an angle *pca* of about 62 deg. 30 min. both theſe ends were ground very true upon a glaſs grinder's braſs-tool, and each of them was compaſſed about with a narrow ferrel of thin braſs *bbbb*; into the upper ſide of the cylinder at E was ſoldered the braſs-pipe EF, and into the under ſide at G, the other braſs-pipe GH, the former of theſe pipes being about three inches long and the latter ſix inches; upon the plate *ddd* were fixed two other plates LL perpendicular to it, and parallel to each other; each of theſe two plates had an arch of a circle, whoſe diameter was equal to that of the cylinder, cut out of its proper edge; ſo that when the pipe GH was let thro' a hole near the middle of the plate *ddd*, the cylinder fell into the arches, and being faſtened there with ſolder, the axis *acx* lay parallel to the plate *ddd*, and about an inch and an half above it; the perpendicular end of the cylinder DC was covered with an object-glaſs of $7\frac{1}{2}$ foot teleſcope *oo*, and the inclining end AB with a well-poliſhed flat glaſs *ff*, which was carefully choſen to tranſmit the object diſtinct enough, notwithſtanding its obliquity to the viſual rays; the ferrels were filled with cement round about the edges of the glaſſes, which lay flat, and every where touched the ſmooth ends of the cylinder, that they might firmly ſupport the weight and preſſure of the excluded air: Inſtead of a ciſtern, as in the *Torricellian* experiment, there was uſed the inverted ſiphon of braſs MNO Fig. 3. ſoldered to the plate *ggg*; one of the ſides MN ſtood perpendicular to the plate *ggg*, and the other NO inclined to it, and was ſupported near the upper end O with a ſmall prop of braſs *kk*: The cylinder was then placed upon a table Fig. 4. which was well faſtened to a firm floor; the pipe GH was let thro' a hole in the top of the table; and the plate *ddd* was nailed down to it; the tube of the teleſcope *sss* with the eye-glaſs in it, was applied to the object-glaſs, and a hair fixed at *x*, the common *Focus* of both glaſſes, in the axis of the cylinder continued upon the floor; under the cylinder was nailed the plate *ggg* with the inverted ſiphon upon it, and M was joined to H

by the inſertion of the glaſs tube T; the joints were very carefully cloſed up with cement, and then covered over with pieces of a bladder tied hard with ſtrong thread; there was alſo a bladder tied below each joint at *m*, and when it was filled with water, it was tied about at *n*, ſo that no air could come to the cement, or inſinuate itſelf thro' its pores or fiſſures, if any happened to be unſtopped; with all this precaution, the experiment ſucceeded at laſt, after this manner; the object *a*, which was a black thread faſtened in a little frame over a piece of white paper, was placed in the axis of the cylinder *xca*; the pipes and cylinder were filled with mercury, and having ſtopped the upper end of the pipe at F with the ſmall iron ſtopple K, and cloſed it at the upper part of the tube and other joints, the mercury was let run gently at O into the bladder *u*, till it remained ſuſpended at the uſual height, as in the barometer, leaving the upper part of the tube and the cavity of the cylinder between the glaſſes *oo* and *ff* void of air; then the object, which before appeared in the axis at *x*, was raiſed conſiderably above it, and it appeared again at *x* by removing it from *a* to a; the axis therefore of the viſual ray, which was alſo the axis of the cylinder *xca*, falling perpendicularly upon the void ſpace, paſſed thro' it without any refraction; but emerging obliquely into the air, it was refracted towards the perpendicular *pc*, and received a new direction to a; and therefore the diſtance *a* a ſubtended the angle of refraction *aca*, all which was meaſured, and was as follows;

	Inch.	dec. pts.
The height of the object above the axis, or the unrefracted viſual ray *a*a — — —	000	425
The diſtance of the object from the refracting plane a *c* about 51 feet or — — —	612	000

	d.	m.	ſ.
Therefore the angle of refraction *aca* was —	00	02	23
The angle of emerſion *pca* (by the conſtruction of the cylinder) was — — —	62	30	00
Therefore the angle of incidence *pca* = *pca* + *aca* was — — — —	62	27	37

And therefore univerſally, according to the known laws of refraction,

The ſines of the angles of incidence being —	100000
The ſines of the angles of emerſion are — —	100036
And the refractive power of the denſe air — —	36

By

By the refractive power of a pellucid body, Mr. *Lowthorp* means that property in it, whereby the oblique rays of light are diverted from their direct course, and which is measured by the proportional differences, always observed, between the sines of the angles of incidence and emersion: This property is not always proportional to the density, at least not to the gravity, of the refracting medium; for the refractive power of glass to that of water is as 55 to 34, whereas its gravity is as 87 to 34; that is, the squares of their refractive powers are very nearly as their respective gravities; and there are some fluids, which, tho' lighter than water, yet have a greater power of refraction; thus the refractive power of spirit of wine, according to Dr. *Hook*'s experiment, is to that of water as 36 to 23; and its gravity reciprocally as 23 to 36, or $36\frac{1}{2}$; but the refractive powers of air and water seem to observe the simple proportion of their gravities directly, as they are compared in the following table; the numbers there expressing the refraction of water are taken from the mean of nine experiments made at so many several angles of incidence, *Jan.* 25th, $164\frac{9}{11}$, by the ingenious Mr. *Gascoigne*; (the first inventor of the micrometer, and the ways of measuring angles by telescopes) and those of air are produced by the preceeding experiment:

	Water	Air
The (assumed) sines of the angles of incidence on the void, from — — —	100000	100000
The sines of the correspondent angles of emersion out of — — — — —	134400	100036
The refractive power of — — — —	34400	36
The specific gravity (if as 900 to 1 at the time of the experiment) of — — —	34400	38
Or (if as 850 to 1) of — — — — —	34400	40

From hence it seems very probable, that their respective densities and refractive powers are in a just simple proportion; and if this should be confirmed by succeeding experiments, made at different angles of incidence, and with cylinders continuing exhausted thro' several changes of the air, it would be more than probable that the refractive powers of the atmosphere are every where, and at all heights above the earth, proportional to its density and expansion; and then it would be no difficult matter to trace the light thro' it, so as to terminate the shadow of the earth, and together with proper expedients for measuring the

quantity of light illuminating an opaque body, to examine at what distances the moon must be from the earth to suffer eclipses of the observed duration.

The Julian Account not to be changed for the Gregorian; *by Dr.* J. Wallis. Phil. Trans. N° 257. p. 343.

THE Dr. does not deny but that there is somewhat of disorder in our ecclesiastical computation of the paschal tables; but at the same time he is very doubtful, that if we go to alter that, it will be attended with greater mischief than the present inconveniency: In the business of geography, by removing upon some plausible pretence, the first meridian from where *Ptolemy* had placed it, tho' a thing at first purely arbitrary, it is now come to pass that we have, in a manner, no first meridian at all; every new map-maker placing his first meridian where he pleases, which has brought great confusion into geography: As to the disorder in the paschal tables it was a thing observed and complained of for 3 or 400 years, before pope *Gregory* unhappily attempted the correction of the calendar; but it was all that time thought advisable to suffer that inconveniency, rather than by correcting it to run the hazard of a greater mischief; and it had been much better if it had so continued to this day, rather than that pope *Gregory* should, upon his own single authority, impose a law on all Christendom to alter their ecclesiastical and civil year for a worse form, than what they had before: Or, if merely upon account of the paschal tables, which was his only pretence, it were thought necessary to make a change, he might have corrected them, or given us new paschal tables instead of those of *Dionysius*, without altering the civil year, which has introduced the confusion of the old and new styles; and which now can never be remedied, unless all nations should at once agree upon one, which is not to be supposed; for if some should alter their style sooner and some later, the confusion in history would be still greater than now it is. The Dr. takes the civil *Julian* year to be preferable to the *Gregorian*; the precession of the equinox for 10 or 12 minutes each year, is a very inconsiderable matter, and in celestial computations is easily rectified, as are many other unequalities of much greater concernment: And it was never pretended that the civil year must needs agree exactly to a minute with the celestial, which is impossible; for the solar and sidereal years differ more from each other, than the *Julian*, which is a mean between them, differs from either; and the seat of *Easter*, which only concerns

cerns the eccleſiaſtical, not the civil year, may eaſily be rectified, if need be, without affecting the civil year at all; or, if not rectified, the celebration of *Eaſter* a week, or a month ſooner or later, doth not influence at all our ſolemn commemoration of Chriſt's reſurrection: And it is agreed by moſt, if not all chronologers, that as to the year of our Lord, the vulgar year is not the true year, tho' it be not agreed how much it differs therefrom; but it would cauſe a great confuſion in hiſtory, if we ſhould now go about to alter the vulgar account: All the pretence, made for altering our ſtile, is only that in ſo doing we ſhould agree with ſome of our neighbours with whom we now differ; but it would then be as true, that we ſhould differ from others, with whom we now agree; but if it be ſaid, that they in time, might come to imitate our example; this would be only making the confuſion ſtill the greater; for then we muſt be obliged, not only to know what countries uſe the new ſtile, but from what period they began ſo to do, if we would underſtand their dates: And if we ſhould by a new law alter the ſtile in *England*, this would not compriſe *Scotland*, which according to the conſtitution of that church is not pliable enough to comply with the modes of *Rome*, as ſome in *England* are; and the buſineſs of *Eaſter* would ſignify nothing to them, who obſerve no *Eaſter* at all, but rather declare againſt it; beſides, this alteration cannot be made without altering the common prayer-book, for at leaſt all the calendar muſt be new framed: And when all is done, there will ſtill be a neceſſity of keeping up the diſtinction of old and new ſtile, which *Pope Gregory*'s pretended correction hath made neceſſary; and with that diſtinction, things may be now as well adjuſted, as if we ſhould change our ſtile: How much better a conſtitution the *Julian* year is, and more adviſeable than the new *Gregorian*, is a thing ſo notorious, that no aſtronomer, who underſtands the methods of aſtronomical calculations, tho' a *Papiſt*, can be ignorant of, however they may pleaſe to diſſemble it; inſomuch that, in their aſtronomical calculations they are fain; firſt to adjuſt them to the *Julian* year, and thence transfer them to their new *Gregorian*; and conſequently how unreaſonable is it for us to exchange our better *Julian* year, for one that is ſo much worſe: It would be much more reaſonable that the *Papiſts* ſhould quit their new *Gregorian*, and return to their own *Julian* year, which they might be induced to do by a bull from the pope. As to what Mr. *Lock* adviſes, *viz.* that for 11 leap-years, we ſhould omit

the

the intercalation of *February* 29, and thenceforth go on with the *Gregorian* account, the laſt of which leap-years would be 1744; but if we begin, as is ſuggeſted, at the year 1700, the laſt of theſe eleven years muſt be 1740, not 1744; this is the ſame expedient that was, during the civil wars, ſuggeſted at *Oxford* in the year 1645; *viz.* that from thence forward, we ſhould omit 10 ſuch intercalations; againſt which there ſeems to the Dr. to be this great objection; *viz.* in the time of *Julius* and *Auguſtus Cæſar*, there was a year, which was called *Annus Confuſionis*, and which happened upon the ſettling, unſettling and reſettling the *Julian* year; and the like happened in the year 1582, when pope *Gregory* did at once ſtrike out 10 days of that year; but would this advice take place, we would now inſtead of one *Annus Confuſionis*, have a confuſion for 44 years together, wherein we ſhould neither agree with the old nor with the new account; but be ſometimes 10 days, ſometimes nine, ſometimes eight, *&c.* later than the one, and ſooner than the other account; and a foreigner would not be able to judge of an *Engliſh* date, without knowing in which of theſe years we vary 10, nine, or eight, *&c.* days from either of theſe accounts, and this for 44 years; which ſeems to the Dr. a much greater confuſion, than if, as in 1582, we ſhould once for all caſt out 11 days; but he does not think it adviſeable to do either.

If it be thought neceſſary to rectify the ſeat of *Eaſter*, that may eaſily be done, without altering the civil year; for if in the rule for *Eaſter*, inſtead of ſaying next after the one and twentieth of *March*, you ſay next after the vernal equinox, the work is done, and we might be excuſed the trouble of paſchal tables, and the intricate perplexities of the *Gregorian* epacts; for then every almanac would inform, when it is the equinox, and when full moon for the preſent year, without diſturbing the civil account; and this pope *Gregory* might have done as well, without diſturbing the accounts of *Chriſtendom*; but if he muſt needs diſturb the civil year, he ſhould have rectified it, not to the time of the *Nicene* council, but to that of the birth of Chriſt: And it is moſt certain, that at our Saviour's birth; the vernal equinox was not on the 21ſt of *March*, as the new account ſuppoſes, but nearer to the 25th.

A Re-

A Report of the Conſultation upon Mr. Dee's *Propoſal for reforming the* Calender A. D. 1582, *by the Lord Treaſurer* Burleigh, *with Reflexions; by Mr.* John Greaves. Phil. Tranſ. N°. 257. p. 355.

IT was agreed on by Mr. *Digges*, Mr. *Savile* and Mr. *Chambers*, who ſeverally peruſed the book written by Mr. *Dee*; viz. *A Diſcourſe upon the Reformation of the vulgar Calendar for the Civil Year*, to allow of his opinion; *viz.* That whereas in the *Roman* calendar reformed, there are 10 days cut off, to reduce the civil year to the ſtate it was in at the council of *Nice*, it had been better to have cut off 11 days, and to have reduced the civil year to the ſtate it had been in at the birth of Chriſt; and therefore the better to agree with all the neighbouring countries, that have received the reformation of ſubſtracting 10 days only, they think it may be allowed of without any manifeſt error; at the ſame time remembring to obſerve certain rules for the future for omitting ſome leap-years in ſome hundred years: And for the ſubſtracting of 10 days, Mr. *Dee* had compiled a form of a calendar beginning with *May*, and ending with *Auguſt* wherein every one of theſe four months, *May*, *June*, *July*, *Auguſt*, ſhall have ſome days deducted, without changing of any feaſt or holy-day, moveable or fixed; or without altering the courſes of *Trinity-term*; that is to ſay, *May* to conſiſt of 28 days, taking three days from it; *June* to have 29 days, taking from it but one day; *July* to conſiſt of 28 days, deducting three days therefrom, and *Auguſt* to conſiſt of 28 days, taking likewiſe three days from it; all which together make 10 days: And becauſe the *Roman* calendar has a great many rules added to it, which ſkillful computiſts or aſtronomers alone are capable of underſtanding; it is thought proper to make a ſhort table like an *Ephemerides*, to continue the certainty of all the moveable feaſts, depending only upon *Eaſter*, and agreeing with the *Roman* calender, which may ſerve for one or two hundred years, and ſo be eaſily renewed when there ſhall be occaſion for it.

As Mr. *Greaves* cannot wholly approve of the reformation of the *Roman* calendar propoſed by Mr. *Dee*, ſo he cannot altogether diſapprove of it; for he likes the ſubſtraction of 10 days, as the church of *Rome* has done, beginning the computation from the council of *Nice*; tho' it cannot be denied, but that the

the reformation from the time of our Saviour had been much better; but since the fathers of the council of *Nice* thought it better to look forwards than to look backwards; and to have a greater care of avoiding distractions in the church, about the celebration of *Easter* for the future, than to remedy past errors; Mr. *Greaves* is of opinion we should do well, with the church of *Rome*, to follow their example: And whereas some have thought of a more exact calculation than this emendation, introduced by pope *Gregory* the XIII. which they ground upon the late astronomical observations of the learned *Tycho Brahe*; yet since the difference is not so great, as to make any sensible error in many ages, and since that error may be easily corrected by the omission of an intercalary day, he does not think it proper, for so small a nicety, to make a new dissention in the church; much less is he of their opinion, who think that this correction of the year is therefore to be rejected, because it comes recommended by the church of *Rome*; which is all one as refusing to take some wholesome potion, because it is prescribed by a physician, whose manners we do not approve of; and thus far Mr. *Greaves* agrees with Mr. *Dee:* But he cannot subscribe to his opinion, that this reformation should be made by the substraction of 10 days out of one year alone, for tho' he grants, that this were a quick cure of a lingering disease, yet it is against all rules of art in curing one malady to make ten; for the defalcation of ten days in one year must create endless disturbance in the commonwealth in all contracts, where necessarily a certain time is defined: And therefore when *Julius Cæsar* the dictator corrected the *Roman* year by the help of the mathematician *Sosigines*, after this manner, that is, by substracting of so many days; that year, in which that deduction was made was called by the antients *Annus Confusionis*, by reason of the great confusion and inconveniencies, which thereby happened; and Mr. *Greaves* doubts not, but that the year 1582, in which the defalcation of ten days was made by the bull or edict of pope *Gregory*, might also be justly stiled *Annus Confusionis*; so that such examples as these are not to be imitated; and therefore Mr. *Greaves* recommends that method which was long since proposed by several able mathematicians to pope *Gregory*, upon the first notice of his purpose of correcting the calendar; *viz.* that for 40 years time there should be no bissextile or intercalary, or as we call them, leap-years, inserted in the calendar; by which means it is most evident, that 10 days

days will be ſubſtracted in 40 years, and theſe 40 years will each of them be *Anni equabiles*, conſiſting of 365 days; as our common and ordinary years do, without any alteration in the whole year.

The Credibility of Human Teſtimony. Phil. Tranſ. N°. 256. p. 359.

MORAL certitude abſolute, is that, in which the mind of man entirely acquieſces, requiring no further aſſurance: As if one, in whom a man abſolutely confides, ſhould bring him word of 1200 *l.* accruing to him by gift, or by the arrival of a ſhip, and for which he therefore would not give the leaſt valuable conſideration to be inſured: Moral certitude incomplete has its ſeveral degrees, to be eſtimated by the proportion it bears to the abſolute; as if one, in whom a perſon has that degree of confidence, as that he would not give above one in ſix to be enſured of the truth of what he ſays, ſhall inform him, as above, concerning 1200 *l.* he may then reckon that he has as good as the abſolute certainty of 1000 *l.* or five ſixths of abſolute certainty for the whole ſum: The credibility of any reporter is to be rated. 1. By his integrity or fidelity; and 2. By his ability; and a double ability is to be conſidered; both that of apprehending what is delivered, and alſo of retaining it afterwards, till it be tranſmitted.

What follows concerning the degrees of credibility is divided into four propoſitions; the two firſt reſpect the reporters of the narrative, as they either tranſmit ſucceſſively, or atteſt concurrently; the third the ſubject of it, as it may conſiſt of ſeveral articles; and the fourth joins thoſe three conſiderations together, exemplifying them in oral and written tradition.

Prop. I. Concerning the credibility of a report, made by ſingle ſucceſſive reporters, who are equally credible: Let their reports have each of them five ſixth's of certainty; and let the firſt reporter give me a certainty of 1000 *l.* in 1200 *l.* it is plain that the ſecond reporter, who delivers that report, will give me the certainty but of $\frac{5}{6}$ of that 1000 *l.* or the $\frac{5}{6}$ of $\frac{5}{6}$ of the full certainty for the whole 1200 *l*; and ſo a third reporter, who has it from the ſecond, would have delivered me but the $\frac{5}{6}$ of $\frac{5}{6}$ of $\frac{5}{6}$ of the full certainty, *&c.* That is if *a* be put for the ſhare of aſſurance a ſingle reporter gives me, and *c* for that which is wanting to make that aſſurance complete; and I therefore be ſuppoſed to have $\frac{a}{a+c}$ of certainty from the firſt reporter,

I ſhall have from the ſecond $\frac{a^2}{a+c^3}$; from the third $\frac{a^3}{a+c^3}$, &c.

And accordingly if a be $=$ 100 and $c = 6$ (the number of pounds that 100 *l.* put out to intereſt brings at the years end) and conſequently my ſhare of certainty from one reporter be $= \frac{100}{106}$ (which is the preſent value of any ſum to be paid one year hence, *viz.* 1699) the proportion of certainty coming to me from a ſecond will be $\frac{100}{106}$ multiplied by $\frac{100}{106}$ (which is the preſent value of money to be paid after two years) and that from a third reporter $= \frac{100}{106}$ thrice multiplied into itſelf, (the value of money payable at the end of three years,) &c.

Corollary. And therefore, as at the rate of *6 per Cent.* intereſt, the preſent value of any ſum payable after 12 years, is but half the ſum; ſo if the probability or proportion of certitude tranſmitted by each reporter be $\frac{100}{106}$, the proportion of certainty after 12 ſuch tranſmiſſions, will be but as a half; and it will be by that time an equal lay, whether the report be true or not: In the ſame manner, if the proportion of certainty be ſet at $\frac{100}{101}$, it will come to a half from the 70th hand; and if at $\frac{1000}{1001}$ from the 695th hand.

Prop. II. concerning concurrent teſtimonies, if two concurrent reporters have each of them as $\frac{5}{6}$ of certainty, they will both give me an aſſurance of $\frac{35}{36}$ or of 35 to one; if three an aſſurance of $\frac{215}{216}$, or of 215 to one: For if one of them gives a certainty for 1200 *l.* as of $\frac{5}{6}$, there remains but an aſſurance of $\frac{1}{6}$ or of 200 *l.* wanting to me, for the whole; and towards that, the ſecond atteſtor contributes, according to his proportion of credibility; that is, to $\frac{5}{6}$ of certainty before had, he adds $\frac{5}{6}$ of the $\frac{1}{6}$ which was wanting; ſo that there is now wanting but $\frac{1}{6}$ of $\frac{1}{6}$, that is $\frac{1}{36}$; and conſequently I have from them both $\frac{35}{36}$ of certainty; ſo from three $\frac{215}{216}$, &c.

That is if the firſt witneſs gives me $\frac{a}{a+c}$ of certainty, and there is wanting of it $\frac{c}{a+c}$; the ſecond atteſtor will add $\frac{a}{a+c}$ of that $\frac{c}{a+c}$; and conſequently leave nothing wanting but $\frac{c}{a+c}$ of that $\frac{a}{a+c} = \frac{c^2}{a+c^2}$; and in like manner the third atteſtor adds his $\frac{a}{a+c}$ of that $\frac{c^2}{a+c^2}$, and leaves wanting only $\frac{c^3}{a+c^3}$, &c.

Corol-

Corollary. Hence it follows, that if a single witness should be only so far credible, as to give me the half of a full certainty; a second of the same credibility would, joined with the first, give me $\frac{3}{4}$; a third $\frac{7}{8}$, &c. so that the co-attestation of a tenth, would give me $\frac{1023}{1024}$ of certainty; and the co-attestation of a twentieth $\frac{2096303}{2097000}$ or above two millions to one, &c.

Prop. III. concerning the credit of a reporter for a particular article of that narrative, for the whole of which he is credible in a certain degree.

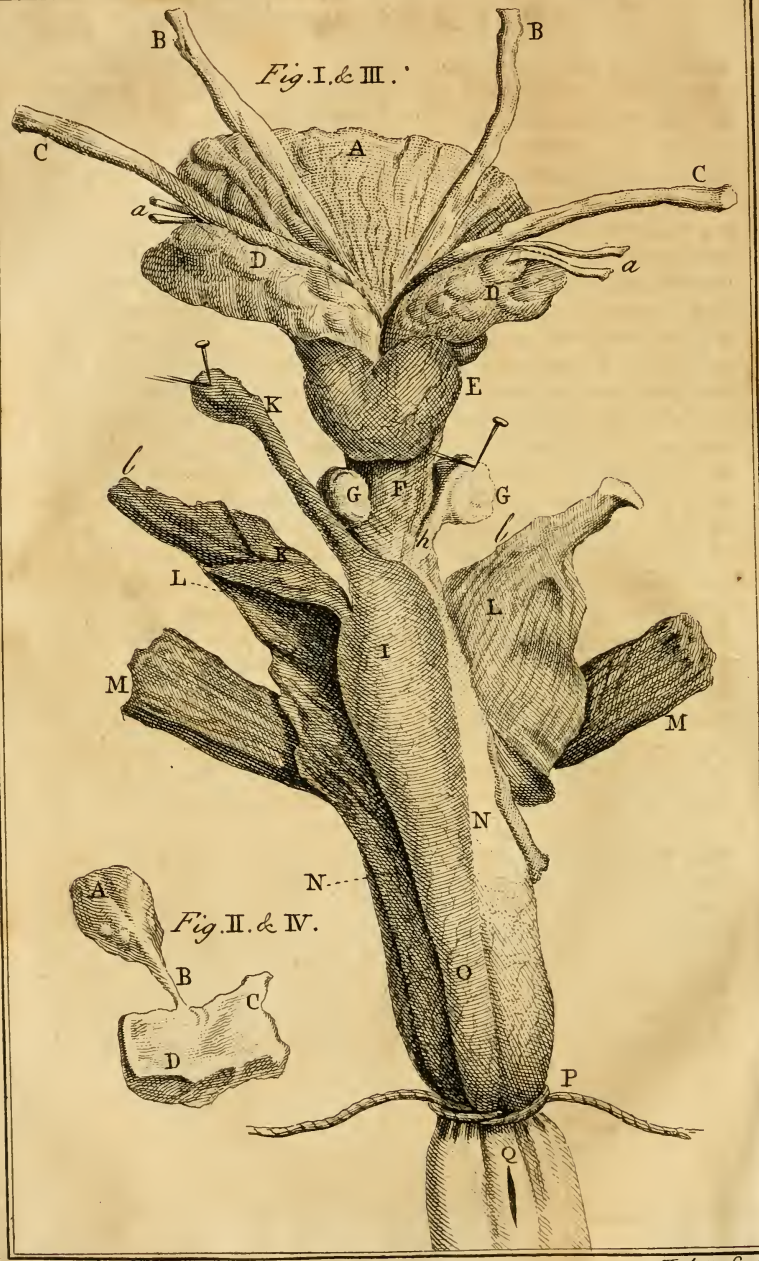
Let there be six particulars of a narrative equally remarkable; if he to whom the report is given has $\frac{5}{6}$ of certainty for the whole, or sum of them, he has 35 to one, against the failure in any one certain particular: For if he has 5 to 1 there will be no failure at all, and if there be, he has yet another 5 to 1, that it does not fall upon that single particular of the six; that is, he has $\frac{5}{6}$ of certainty for the whole, and of the $\frac{1}{6}$ wanting, he has likewise $\frac{5}{6}$ or $\frac{5}{36}$ of the whole, more; and therefore that there will be no failure in that single particular, he has $\frac{5}{6}$ and $\frac{5}{36}$ of certainty, or $\frac{35}{36}$ of it: In general, if $\frac{a}{a+c}$ be the proportion of certainty for the whole, and $\frac{m}{m+n}$ be the chance of the rest of the particular articles m, against some one, or more of them n; there will be nothing wanting to an absolute certainty, against the not failing in the article or articles n but only $\frac{nc}{m+n \times a+c}$

Prop. IV. concerning the truth of either oral, or written tradition, in whole or in part, successively transmitted, and also co-attested by several successions of transmittents.

1. Supposing the transmission of an oral narrative to be so performed by a succession of single men, or joined in companies, as that each transmission, after the narrative has been kept for 20 years, impairs the credit of it a 12th part; and that consequently at the 12th hand, or at the end of 240 years, its certainty is reduced to a half; and there grows then an even lay (by the corollary of the 2d proposition) against the truth of the relation; yet if we further suppose, that the same relation is co-attested by 9 other several successions, transmitting alike each of them, the credibility of it, when they are all found to agree, will (by the corollary of the first *prop.*) be as $\frac{1023}{1024}$ of certainty, or above a thousand to one; and if we suppose a co-attestation of 19, the credibility of it will be above two millions to one.

2. In oral tradition, as a ſingle man is ſubject to much caſualty, ſo a company of men cannot be ſo eaſily ſuppoſed to join; and therefore the credibility of $\frac{1}{100}$ or about $\frac{1}{2^6}$ may poſſibly be judged too high a degree for an oral conveyance, to the diſtance of 20 years: But in written tradition, the chances againſt the truth, or conſervation, of a ſingle writing are far leſs; and ſeveral copies may alſo be eaſily ſuppoſed to concur, and thoſe ſince the invention of printing exactly the ſame; as alſo ſeveral diſtinct ſucceſſions of ſuch copies may be as well ſuppoſed, taken by different hands, and preſerved in different places or languages: And therefore if oral tradition by any one man or company of men, might be ſuppoſed to be credible after 20 years, at $\frac{1}{2^6}$ of certainty, or but $\frac{5}{10}$ or $\frac{4}{6}$, a written tradition may be well imagined to continue, by the joint copies that may be taken of it for one place (like the ſeveral copies of the ſame impreſſion) during the ſpace of 100, if not 200 years; and to be then credible at $\frac{1}{2^{50}}$ of certainty, or at the proportion of 100 to one: And then ſeeing that the ſucceſſive tranſmiſſions of this $\frac{1}{100}$ of certainty, will not diminiſh it to a half, untill it paſſes the 69th hand (for it will be near 70 years before the rebate of money, at that intereſt will ſink it to half) it is plain that written tradition, if preſerved but by a ſingle ſucceſſion of copies, will not loſe half of its full certainty, until 70 times 100, if not 70 times 200 years are paſt; that is 7,000, if not 14,000 years: And further, that if it be likewiſe preſerved by concurrent ſucceſſions of ſuch copies, its credibility at that diſtance may be even increaſed, and grow far more certain from the ſeveral agreeing deliveries at the end of 70 ſucceſſions, than it would be at the very firſt from either of the ſingle hands.

3. Laſtly, in ſtating the proportions of credibility for any part or parts of a copy, it may be obſerved, that in an original, not very long, good odds may be laid, that a copy by a careful hand ſhall not have ſo much as a literal fault; but in one of greater length, that there may be greater odds againſt any material error, and ſuch as ſhall alter the ſenſe; greater yet, that the ſenſe ſhall not be altered in any conſiderable point; and ſtill greater, if there be many of thoſe points, that the error hits not upon ſuch a ſingle article, as in the third propoſition.



G. Smith del. Hulett Sculp

Two new Glands *near the* Proſtatæ, *with their excretory Ducts diſcovered; by Mr.* William Cowper. Phil. Tranſ. N° 248. p. 364.

ABOUT a quarter of an inch below the *Proſtatæ* or proſtate glands, Fig. 1. Plate XII. Mr. *Cowper* found two other ſmall glands GG, placed on each ſide the *Urethra* F, a little above the bulb of its cavernous body I; theſe glands are of a depreſt oval figure, about the ſize of a ſmall *French* bean: After that theſe parts of the *Muſculus accelerator* L L are removed, which paſs over theſe glands, you may feel them placed like two hard bodies on each ſide the *Urethra*; they incline to a yellowiſh colour, like that of the *Proſtatæ*; their excretory ducts appear on their internal ſurface Fig. 2. A *b*, next the inner membrane of the *Urethra* C, whence they deſcend about half an inch in length, before they grow leſs, and pierce that membrane obliquely at their opening into the *Urethra* D, in which they diſcharge their ſeparated liquor: After opening the upper part of the *Urethra* towards the *Dorſum Penis*, and expanding its inner membrane, if you compreſs theſe glands, you may ſee a liquor iſſue from two diſtinct orifices, which is very tranſparent and tenacious; theſe two orifices open into the *Urethra*, juſt below its bending under the *Oſſa Pubis* in the *Perinæum*: The mechaniſm of nature is very extraordinary in thus placing theſe glands and their excretory ducts, ſince upon the erection of the *Penis*, and the diſtenſion of the bulb of the cavernous body of the *Urethra*, they are thereby neceſſarily compreſs'd, and the liquor contained in their excretory ducts, forced thro' their two orifices, into the cavity of the *Urethra*; beſides this, that part of the *Muſculus accelerator* mentioned above, which paſſes over theſe glands, contributes to this compreſſion: It ſeems requiſite ſuch agents ſhould conſpire in compreſſing theſe organs, ſince the liquor they ſeparate is ſo very tenacious, which conſiſtence is abſolutely neceſſary for the uſes it is employed in: The main deſign of nature in framing theſe glands, ſeems to reſpect the grand work of generation, which will be more evident, if we examine the analogous organs in other animals; in rats theſe glands are remarkably large, and are ſo ſituated that, upon the erection of the *Penis*, they are compreſſed by its turgency and the appoſition of the *Oſſa Pubis*; the like may be obſerved in other animals, particularly in hedge-hogs; boars have theſe glands very large, and the matter they ſeparate is more

more tenacious, and not so transparent as what Mr. *Cowper* found in all the other animals he examined; there is something particular in their contrivance in this animal, each gland being covered with a peculiar muscle not unlike the gizzards of some fowl; which mechanism seems contrived for more forcibly compressing them, to discharge their very tenacious contents into the *Urethra*, and that not only in the time of coition, but at any other time; which seems to be more particularly required in those animals, because the passage of their urine is very long, and therefore stands in need of more of this glutinous matter to besmear it, whereby it is defended from the injuries that may arise from the salts of the urine: As the urine of different animals is more or less impregnated with pungent salts, so the proportion of those glands differ as well as on account of the various lengths of their *Urethra*'s: It is remarkable we do not find these glands in females, like those in males, tho' they have something analogous to them, which are described by *de Graeff*, and called *Prostatæ Mulierum*; but the orifices of their excretory ducts, opening at the extremity of the *Urethra*, they serve not only to defend the *Nymphæ* and *Labia Pudendi*, from the urinous salts; but also to discharge their liquor *in coitu*; the whole *Urethra* in them being so short, that the contraction of the sphincter muscle of the bladder is sufficient to expel any remains of urine from that passage: The use of these glands is two-fold; first, on the erection of the *Penis*, there is so much of their liquor discharged into the *Urethra*, as suffices to drive out any remains of the urine, and prevent its mixing with the *Semen*; and at other times the continual discharge of some part of their liquor into the *Urethra*, defends that passage from the salts in the urine; the like continual exsudation cannot happen either from the excretory ducts of the *Prostatæ*, or those of the *Vesiculæ seminales*, because the nearness of the *Sphincter muscle* so corrugates the inner membrane of the *Urethra*, as to prevent an easy passage of the liquor by the *Ostiola* of the former; nor can the *Semen* run out of the latter, since the *Caruncula* or *Caput Gallinaginis*, is contrived on purpose to prevent it; wherefore the diaphragm, abdominal muscles, and *Levatores Ani* are employed in compressing those parts to discharge their contents: It is not improbable that the matter, which flows at the latter end of the cure of the veneral disease, and is called a gleet, proceeds from these glands, and not from the *Prostatæ* or *Vesiculæ Seminales*, as is commonly supposed; which may afford no inconsiderable

derable argument for the use of injections in such cases; instead of which some practitioners give their patients violent purges, and large quantities of astringent medicines: We may easily conceive that such gleets become sometimes very obstinate, if not incurable if we suppose that the ulcer in that contact happens to be upon the *Ostiola* of these excretory ducts. Plate XII. Fig. 3. A is a portion of the bladder; B B are parts of the *Ureters*; C C parts of the *Vasa Deferentia*; D D the *Vesiculæ Seminales* somewhat distended with wind, by blowing into the *Vasa Deferentia*; *a a* the blood vessels of the *Vesiculæ Seminales*; E the *Glandulæ Prostatæ*; F the *Urethra* expanded, after opening its superior and fore-part, to shew the *Ostiola* of the excretory ducts of the following glands; G G are the two glands above described, which, from the liquor they separate, may be called *Glandulæ Mucosæ*; *h* the excretory duct of the last mentioned glands, before it passes under the bulb of the cavernous body of the *Urethra*; I, the bulb of the cavernous body of the *Urethra*, partly distended with wind, and divested of the accelerator muscle, to shew its external membrane, which is very thin, whereby the last mentioned muscle does more adequately compress that bulb, and derive its contained blood towards the glands, when the *Penis* is erected; K the third pair of muscles of the *Penis*; L L the accelerator muscle, divided in the middle seam on the bulb, and afterwards freed from it and expanded; *l l* the upper part of this muscle, which passes immediately over the mucous glands; M M the *Musculi Directores Penis*; N N the cavernous bodies of the *Penis*; O the cavernous body of the *Urethra*; P the ligature made to prevent the wind from passing out of the cavernous body of the *Urethra*, and its bulb; Q the aperture by which the inflation was made; Fig. 4. is one of the mucous glands after being macerated in water, and its excretory duct filled with quicksilver; A the mucous gland somewhat distended; B its excretory duct; C a portion of the internal membrane of the *Urethra* expanded; D the *Ostiola* of the last mentioned excretory duct.

The Organs *of Hearing*; *by Dr.* Raymund Vieussens. Phil. Transf. N° 258. p. 370. *Translated from the* Latin.

ALTHO' the celebrated *Du Verney*, a Man much conversant not only in anatomical, but likewise in physical and medical matters, hath written well on the organ of hearing, and accurately described it; yet Dr. *Raymund Vieussens* has discovered some new things in its internal structure, which will appear neces-

neceſſary both for the more eaſy explication of the ſenſe of hearing it ſelf, and to account for the diſeaſes incident to that organ: In the firſt place he diſcovered a membrane of a very fine and curious texture within the cavity of the *Tympanum* or drum of the ear, which with regard to the place it poſſeſſes, he calls the interior membrane of the *Tympanum*, to diſtinguiſh it from that which cloſes up the extremity of the *Meatus auditorius*, and which he calls the exterior membrane of the *Tympanum*: This membrane in each ear, if narrowly viewed, appears to be furniſhed with a vaſt number of capillary veſſels, proceeding from the carotid artery and jugular vein on each ſide; hence it happens, that theſe ſmall veſſels being greatly diſtended with blood, the membrane appears almoſt entirely red, when viewed in the ſun, but eſpecially in a microſcope; theſe ſmall veſſels prevent the ſuperior and lateral parts of the membrane, which ſupport them from collapſing and being folded up, as undoubtedly they would be, unleſs they were thus ſuſpended; for theſe parts do not immediately adhere to the interior ſuperficies of the cavity wherein they are contained: This membrane, which is a production of that thin one that covers the interior parts of the aquæduct, ſhuts up the paſſage that leads to the *Cellulæ* of the *Apophyſis Maſtoides*; and therefore prevents the free communication betwixt the air included therein, and that which enters the *Tympanum*; beſides that, one of its fine productions ſtops up the aperture of the *Stapes*, and the other the *Foramen* commonly called *Rotundum*, and extending further, is ſpread over all the interior ſuperficies of that ſmall hollow ſpace, which reaches from the *Foramen Rotundum* to the extremity of the ſemi-oval duct of the *Cochlea*, and to the *Rimula* or little chink in the baſis of the *Concha*; ſo that the interior membrane of the *Tympanum*, by this its production, communicates with that part of the nervous membrane, which is ſpread over the interior *Parietes* of the *Concha*, and alſo with the extremity of the nervous ſpiral *Lamina* or plate, which lies within the ſemi-oval ſpiral duct of the *Cochlea*; beſides, this membrane, beneath that part of it, which regards the external membrane of the *Tympanum*, leaves a large void ſpace which receives the external air conveyed to it by the aquæduct, and is ſo folded up, and complicated as to form three cavities; the firſt of which poſſeſſes that ſpace that lies between the external *Apophyſis* of the *Incus*, and the paſſage which leads to the *Cellulæ* of the *Apophyſis Maſtoides*, as was obſerved above; the ſecond, which is between the firſt and third cavities, and leſs than either, lies exactly under

under the basis of the *Concha*, and incloses the head of the *Malleus*, and almost the whole *Incus*; the third cavity, which is the largest of all, regards the internal orifice of the aquæduct, and contains in it a portion of the belly of the first muscle of the internal ear, and of the *Incus*, together with both its *Apophyses*, and also incloses the *Stapes*, *Os lenticulare*, the tendon of the second muscle of the internal ear, together with the neck, and handle of the *Malleus*: In fine this membrane, is formed in some subjects in such a manner, as that a small portion of it becomes a very slender little membrane like a partition wall, which equally divides the space comprehended by the third and greatest cavity; this little membrane has not been described by any anatomist, so far as *Vieussens* could learn, as rarely occuring, and where it is found, it adheres to the superior part of the basis of the *Concha*, and by its inferior to the external membrane of the *Tympanum*, which closes up the extremity of the *Meatus Auditorius*, and seems to intersect it transversely into almost two equal parts, as far as the extremity of the handle of the *Malleus*, to which it adheres; nay and a little farther; so that this little membrane, together with the extremity of the handle of the *Malleus*, draws the middle part of the external membrane of the *Tympanum* towards the internal parts of its cavity, and gives it such an inclination as to be a little concave towards the *Meatus Auditorius*, and a little convex towards the cavity of the *Tympanum*; this little membrane, in subjects where it is found, is apt to hinder the exterior membrane of the *Tympanum* from being stretched too much by the violent contractions of the monogastric muscle of the internal ear, or from being torn by the extremity of the handle of the *Malleus*, when the above mentioned muscle is affected with any convulsive motions; so that the little membrane seems in some measure to supply the office of an antagonist to the monogastric muscle, if it be considered as acting by its slender and longer tendon, as will afterwards appear; if any one would satisfy his curiosity in this respect, let him separate the *Os Petrosum* from the rest of the scull of a person that has been strangled; or of one that has died of a phrensy or apoplexy, after which it must be laid up in a dry place for two days, that the membrane just now mentioned may become somewhat dry, and contracted, in order the better to separate it from the internal superficies of the cavity wherein it is contained, and to prevent its being torn; afterwards that very thin bone, which constitutes the superior part of the *Tympanum*, must be skilfully cut away with a knife into small pieces; which is no sooner done, than this membrane that before lay concealed

within its cavity, presents itself to view, being furnished with so many capillary vessels, that when each of them is distended with blood, it appears somewhat like the *Rete mirabile:* This membrane is designed for admirable uses, as shall be presently shewn: 1. By its very fine production closing up the entrance to the labyrinth, it hinders the pure and subtile air that is lodged within its various cavities and meanders, from having at least a free communication with that gross air that is received thro' the aquæduct into the cavity of the *Tympanum*. 2. This membrane gently warms the bony basis of the labyrinth with the heat of the blood contained in the vessels, with which it is furnished; and at the same time cherishes and preserves the motion of the air included in both the *Vestibula*, and in all their winding canals, as also of that defecated *Lympha* impregnated with animal spirits, wherewith each shoot of the *Portio Mollis* of the ear is moistened. 3. This membrane does also contain within its cavities air very much rarefied by the gentle heat of the blood in its vessels, which being exceeding fine and plentifully impregnated with the æthereal matter, it is greatly fitted easily to receive all the impressions of sonorous objects, and convey them quickly to the air, and to each branch of the *Portio Mollis*, wherewith the inside of the labyrinth is furnished, as also to the *Centrum Ovale* of the brain; from what has been just mentioned, it plainly follows that this membrane admirably contributes to the sense of hearing; for being of a fine and curious texture, it gives both a free ingress and egress to all the impressions of sonorous bodies, which are transmitted to it, as soon as they are communicated to the circumambient air, by the motion of that æthereal matter wherewith the air is impregnated, which pervades the innumerable small *Foramina* of the external membrane of the *Tympanum*, and likewise by the interposition of the aquæduct; and according to *Vieussens* every impression of sound, by means of the air contained within the cavities of this membrane, as also of the circumambient external air, impregnated with æthereal matter, is in a moment conveyed into the labyrinth thro' its *Porta* and *Fenestra*, and from thence transmitted to the *Centrum Ovale* of the brain by means of the animal spirits, where divers ideas of different species and different denominations are excited in the mind according to the diversity of the impressions of sonorous bodies; the truth of which is confirmed by experience; for when the purulent matter of an imposthume within the *Apophysis Mastoides*, or within the *Tympanum* itself, has quite corroded this membrane, the sense of hearing is either much impaired or entirely lost: From what has been said, it plainly

plainly appears, that a tumultuary ſort of motion, producing a preternatural ſound is neceſſarily excited within the *Tympanum*, as often as there is tranſmitted into the veſſels of this membrane too great a quantity of much rarified and vaporous blood, ariſing from ſurfeits, obſtructions in the lower belly, long and painful ſtudy, &c. which blood, from its too great quantity and rarefaction gives too high a pulſe and dilates too much the ſmall arteries in which it is conveyed; by which and a plentiful emiſſion of vapours, it ſtrikes ſo upon this membrane, as to occaſion a certain confuſed tumultuary noiſe within the *Tympanum*; eſpecially, if by reaſon of an obſtruction in the aquæduct, or the too cloſe texture of the exterior membrane of the *Tympanum*, theſe vapours cannot eaſily perſpire: The impreſſion of this noiſe tranſmitted to the *Centrum Ovale* of the brain, excites in the mind an idea, which is commonly called a noiſe in the ear; of which there are three ſorts; *viz. Bombus* a humming, *Sibilus* a hiſſing, and *Tinnitus* a tingling noiſe: When the vapours that occaſion a murmuring noiſe in the ears, being too plentiful, and agitated too much, are ſo moiſt, as to approach pretty near to the nature of water, they relax the interior membrane of the *Tympanum*, and being eaſily moveable, they bend and turn it every way; hence it happens, that this membrane being ſomewhat relaxed and bent by the various and undulatory motion communicated thereto, agitates in ſuch a manner not only the circumambient air, but likewiſe that contained within its cavities, as to have proper vibrations in a ſlow ſucceſſive manner communicated thereto: Theſe vibrations by means of the animal ſpirits, contained in the *Portio Mollis* of the ear, are conveyed to the *Centrum Ovale* of the brain, and excite in the mind that idea, which repreſents that confuſed noiſe, commonly called *Bombus*: When the vapour that excites a noiſe in the ears is ſo deſtitute of watry particles, as to be of the nature of a dry exhalation, rather than a mere vapour, and ſo becomes flatulent; this ſtriking againſt the interior membrane of the *Tympanum* in ſome meaſure dries and expands it; hence it is that this membrane excites ſtrong vibrations, which are indeed ſucceſſive, but very quick, and move in ſtreight lines or nearly ſo; and that ſuch vibrations are almoſt like thoſe produced by a mere *Flatus*; theſe likewiſe, tranſmitted to the *Centrum Ovale* of the brain, in the manner above explained, excite in the mind an idea that repreſents a tumultuary ſharp ſound, commonly called *Sibilus*: When the interior membrane of the *Tympanum*, or any part thereof, has frequent and ſtrong pulſes, which quickly ſucceed each other, from the ſmall arteries with which it is furniſhed,

niſhed, on account of the flux of the blood ſomewhat impeded; if at that time it happen to be dilated with a very hot and dry vapour, ſo as ſtrongly to reflect the pulſations; in that caſe it agitates both the ambient air, and that included in its cavities in ſuch a manner, as to yield the very ſame, or nearly the ſame vibrations with thoſe produced by the ſmall and quick reiterated ſtrokes of a ſilver hammer, upon an anvil of ſilver, or ſome ſuch ſonorous metal, and which for that reaſon is apt to cauſe a ſtrong re-percuſſion; hence it is no wonder, that ſuch vibrations, when they reach the *Centrum Ovale* of the brain, excite in the mind an idea, which repreſents a preternatural noiſe commonly called *Tinnitus: Vieuſſens*, on frequent examination, never obſerved more than two muſcles of the internal ear, which receive almoſt imperceptible nerves from the fifth pair, and are furniſhed with very ſmall blood-veſſels, which are ramifications of the carotid artery and jugular vein; the firſt of theſe muſcles is thicker and longer than the other, having two heads and two tendons or tails, but one belly, which therefore he calls the monogaſtric muſcle; the firſt head is covered with a membranous coat, and ariſes from a little bony *Sinus* above the ſuperior part of the aquæduct; the ſecond head, which appears altogether fleſhy, takes its riſe not far from the external ſide of the above bony *Sinus*; the fleſhy fibres that compoſe theſe two heads are very cloſely united a little before they enter the cavity of the *Tympanum*, and then they terminate in one belly, enveloped with a ſtrong membranous coat; after which, theſe fleſhy fibres, extending themſelves towards the cavity of the *Tympanum*, a little after they have entered it, are again ſeparated, and become two tendons enveloped in a ſtrong membranous coat: The firſt of theſe is longer and more ſlender than the ſecond, and after raiſing itſelf a little upwards, by means of a ſmall membranous pulley, it is connected to that part of the *Os Petroſum*, where the aquæduct of *Fallopius* begins, or that bony canal, which receives the *Portio Dura* of the ear; ſo that by the help of this membranous pulley, it performs all its motions freely; this tendon bending downwards, deſcends perpendicularly upon the ſlender *Apophyſis* of the *Malleus*, and by expanding itſelf a little, is connected therewith, hence it happens that its connection extends as far as the neck of the *Malleus:* The ſecond tendon of this muſcle is ſhorter, and thicker than the firſt, and covered with a pretty thick membranous coat, extends almoſt in a ſtreight line to the cavity of the *Tympanum*, and is faſtened to the middle part of the head of the *Malleus*, and is ſo expanded, as to reach the body of the *Incus*, and thus it ſerves for connect-

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ing both these bones together; this tendon by means of its membranous coat is connected with the bone on which it is spread: The second muscle of the internal ear arises from a bony tube in the lower part of that bone, which lies between the *Porta* and *Fenestra* of the labyrinth; and is much less and shorter than the monogastric muscle above described; from hence *Vieussens* calls it the lesser muscle of the internal ear; it has a thick fleshy belly, and is inserted by a very slender tendon into the head of the *Stapes*.

Whilst the monogastric muscle of the ear contracts itself, its longer tendon raises the head of the *Malleus* and body of the *Incus*, a little upwards, and but a little; because that the shorter tendon of that muscle, as being connected by its extremity to the head of the *Malleus* as the longer tendon is to its slender *Apophysis* and neck, is an antagonist to the longer; and because it is connected by its coat to the bone upon which it lies: When the head of the *Malleus* is raised upwards, the extremity of its handle is necessarily depressed; and by this means the middle part, to which the handle adheres, of the external membrane of the *Tympanum* is drawn outwards, and thus its superficies is made plane or nearly so: Whilst the tendon of the monogastric muscle of the ear, and the *Malleus* perform these several offices, they extend the small membrane above described, that in subjects, where it is found, cuts the exterior membrane of the *Tympanum* transversely; and it seems in some measure to supply the place of an antagonist to the monogastric muscle of the ear, because by its elasticity it recovers its natural state of tension, and with the same *Nisus* assists the exterior membrane of the *Tympanum* to recover its tension and figure, when it is no longer pressed by the extremity of the handle of the *Malleus*: As by raising the head of the *Malleus* upwards, the extremity of the handle is inclined a little downwards; so also by raising the *Incus* upwards, the extremity of its internal *Apophysis* is depressed a little, and but a little; because the *Incus* is so situated in the cavity of the bone, that forms the external rim of the basis of the *Tympanum*, that its body cannot be raised upwards, but at the same time its external *Apophysis* presses by its extremity upon the bone that is under it, and to which it is very near; hence it is that the monogastric muscle of the ear cannot by its longer tendon raise the *Incus* much: When the body of the *Incus* is a little elevated, and its internal *Apophysis* depressed a little, at the same time it draws with it, and consequently depresses a little the head of the *Stapes*, to which it is connected by means of the *Os lenticulare*; and whilst

whilſt the head of the *Stapes* is depreſſed a little, the ſuperior part of its baſis neceſſarily recedes ſomewhat from the ſuperior part of the *Feneſtra Labyrinthi*, on which it lies, and ſo opens it a little, and as it were, ſtrikes upon it: From what has been ſaid, it eaſily appears that the longer tendon of the monogaſtric muſcle of the ear contributes two ways to render hearing more eaſy and perfect; firſt as it ſtretches, by the extremity of the handle of the *Malleus*, the exterior membrane of the *Tympanum*, and renders its ſurface plane, or ſomewhat near it, as was explained above; again, as it enlarges a little its pores, ſo that when the æthereal matter charged with the impreſſions of ſonorous bodies, arrives at this membrane, it finds them ſo dilated, that entering the cavity of the *Tympanum*, it paſſes eaſily thro' them: As ſoon as it enters the cavity of the *Tympanum*, it gently diffuſes itſelf into that æthereal matter, which fills up the pores of the included air, and conveys the impreſſions into the labyrinth by its *Porta* and *Feneſtra*; as ſoon as the impreſſions of ſonorous objects reach the internal parts of the labyrinth, they there ſtrike on the animal ſpirits impregnated with æthereal matter, and lodged within the various branches of the *Portio Mollis* of the ear, and theſe latter tranſmit their mere character to the *Centrum Ovale* of the brain, where they excite ſuch ideas in the mind, as by divine appointment they are adapted to do; again, the longer tendon of the monogaſtric muſcle of the ear ſerves to facilitate and perfect the ſenſe of hearing, as it opens a little the ſuperior part of the *Feneſtra Labyrinthi*, in the manner above explained; for, in the mean time, whilſt one portion of the æthereal matter conveys the impreſſions imparted to it by ſonorous objects, and enters more eaſily the ſecond *Veſtibulum* of the labyrinth, another part enters the firſt: Upon the contraction of the monogaſtric muſcle of the ear, it draws a little towards itſelf, by its ſhort tendon, the head of the *Malleus* together with the *Incus*; ſo that the extremity of the handle of the *Malleus*, and the point of the internal *Apophyſis* of the *Incus* are neceſſarily drawn from the internal, towards the external parts of the *Tympanum*; and whilſt the extremity of the handle of the *Malleus* is drawn from the cavity of the *Tympanum* towards the *Meatus Auditorius*, it neceſſarily depreſſes the convex part of the exterior membrane of the *Tympanum*, to which it is connected, and thus it contributes very much to the increaſe of its natural tenſion, and to render both its ſuperficies plane: When the acute part of the internal *Apophyſis* of the *Incus* is inclined from the internal towards the external parts of the *Tympanum*, it neceſſarily draws the head of the *Stapes*,

Stapes, to which it is connected, by means of the *Os lenticulare*, and so removes a little the internal and lateral part of the basis of this small bone from the internal and lateral part of the *Fenestra Labyrinthi*; between both which there is formed a small *Rimula*, which affords a passage into the *Concha* for the æthereal matter that comes loaded, as it were, with the impressions received from sonorous bodies, and that is about to enter into the labyrinth: From what has been said, it plainly appears that both the tendons of the monogastric muscle of the ear are designed for the same uses; altho' their motions, as being in different directions, are differently performed, so as to resist each other, as may be seen from what is said above; and indeed each of them in a peculiar manner stretches the exterior membrane of the *Tympanum*, and endeavours to make it plane; by which means it gives a more ready access to the æthereal matter into the cavity of the *Tympanum*, that carries along with it the impressions of sonorous bodies; whilst the longer tendon opens a little the superior part of the *Fenestra Labyrinthi*, the shorter one does a little open the lateral and internal part of the same *Fenestra*; so that the chink made by this means admits some portion of the æthereal matter into the *Concha:* The lesser muscle of the internal ear, if considered with regard to its rise and insertion, cannot contract itself, but at the same time it must draw the head of the *Stapes*, in which it is inserted, from the external towards the internal parts of the *Tympanum*, and so open a little the lateral and external part of the *Fenestra* of the labyrinth, to give admission to the æthereal matter into the *Concha:* From this it very plainly appears, that this lesser muscle of the ear, whilst it contracts itself, and the monogastric muscle, considered as acting by its shorter tendon, open the *Fenestra Labyrinthi* in a quite different manner; and hence doubtless it is, that by reason of these natural opposite motions of both these muscles, the *Fenestra Labyrinthi* never opens but a little, and that only on its external side by the action of the lesser muscle: On the contrary this *Fenestra* is open in its superior parts, and at the same time on its internal side, where the monogastric muscle contracts itself, as has been fully and plainly shewn above: That the parts already described, with which the cavity of the *Tympanum* is furnished, naturally serve for the uses assigned them, *Vieussens* thinks cannot be called in question; since the sense of hearing is impaired as often as their natural state is changed; yet he would not have any one think, that these parts are absolutely necessary to that sense; because he has observed more than once, in dis-

diſſecting human ſubjects, that both the external and internal membranes of the *Tympanum*, nay, and ſometimes the greater portion of its muſcle was wanting, theſe parts having been corrupted, nay entirely waſted by the ſharp purulent matter of an impoſthume, either in the *Cellulæ* of the *Apophyſis Maſtoides* or in the cavity of the *Tympanum* itſelf; and yet in all the ſubjects, wherein one or both ears had an impoſthume, the ſenſe of hearing was not entirely loſt in the ear affected, as he learned from the perſons themſelves while alive.

Vieuſſens upon weighing attentively, whether both muſcles of the internal ear moved voluntarily or not, was of opinion, that they are put into motion, partly by the will, partly by impreſſions received from ſonorous bodies, without the knowledge, and ſometimes againſt the will of the ſoul; ſo that they move partly voluntarily and partly involuntarily; and in reality it is very probable that, by the ſame act of the will, by which we are determined to hear any thing eaſily and diſtinctly, the animal ſpirits are alſo determined to flow towards theſe muſcles, in order to promote their motion, by which means the perception of a ſound is rendered more expeditious and diſtinct; yet ſtill the motion of the muſcles of the internal ear cannot be ſaid to be merely voluntary, ſince every one by his own experience may be convinced, they often move contrary to his inclination: And the caſe being ſo, there is no other extrinſic cauſe to determine the muſcles of the internal ear to motion, than the æthereal matter, charged with the impreſſions of ſonorous bodies; and that ſuch a cauſe excites them to motion in the following manner, *Vieuſſens* thinks is very probable; when the æthereal matter arrives at the external membrane of the *Tympanum*, in repeated vibrations, which are ſometimes quicker and ſometimes ſlower, it is almoſt entirely conveyed into its cavity, and both then, and when it pervades its pores, it ſtrikes that membrane, and protrudes it towards the internal parts of the head; upon which it drives the extremity of the handle of the *Malleus*, connected to it, from the *Meatus Auditorius* towards the cavity of the *Tympanum*, and elevates it, and at the ſame time depreſſes its head, together with the *Incus*, faſtened thereto; whilſt the head of the *Malleus* and the *Incus* are thus depreſſed, they draw towards them the two tendons of the monogaſtric muſcle of the internal ear, extend the whole muſcle, and diſpoſe it in ſuch a manner as to acquire an elaſticity fitted to promote its contraction; but ſince the vibrations of the air impregnated with the æthereal matter, tho' they follow quick upon each other, are always diſtinguiſhable by certain ſmall intervals

ervals of time, yet *Vieuſſens* ſuppoſes it certain, both from the period of time, for inſtance, between the firſt and ſecond vibration, and from its gentle extenſions, that the ſaid muſcle is determined to a contraction, with that elaſticity it acquired whilſt extended; and that it is actually contracted, by means of the animal ſpirits, which had juſt entered the pores of its fibres: The contraction of the monogaſtric muſcle draws the *Stapes* from the internal towards the external parts of the *Tympanum*, and thus extending the leſſer muſcle of the internal ear, diſpoſes it in ſuch a manner, as that it acquires an elaſticity, by which it is fitted and determined to contract itſelf; and as ſoon as the monogaſtric muſcle is again extended, in the manner juſt now explained, it is actually contracted by means of the animal ſpirits.

Vieuſſens comes next to conſider the internal and external parts of the labyrinth; and he gives an account of the bone, which conſtitutes the internal *Parietes* of each of its cavities, and which he ſays is white, very hard, and compact; it ſeems to be formed thus by nature, that when the æthereal matter, charged with the impreſſions of ſonorous bodies, ſtrikes upon the ſaid *Parietes*, it may loſe little or nothing of its motion, but communicate it, the ſame or nearly ſo, to the animal ſpirits contained within the ramifications of the *Portio Mollis* of the ear, which are variouſly ſpread on the internal parts of the labyrinth, as will afterwards be ſhewn: In the external parts of the labyrinth, there are only three things obſervable; *viz.* a bony partition which poſſeſſes its ſuperior part, and by which its three ſemi-circular ducts are ſeparated from each other, together with two apertures not far from one another, by which the æthereal matter is conveyed from the cavity of the *Tympanum* into the labyrinth; this portion of the *Os Petroſum*, has this in peculiar, that its internal texture is cellular, in which a great number of capillary blood-veſſels are diſſeminated, and the gentle heat of the blood conveyed in theſe veſſels, cheriſhes and preſerves the natural motion of the animal ſpirits, lodged in the pores of the ſmall nervous membranes within the ſemi-circular ducts of the labyrinth, and ſo prevents their being too much condenſed, and becoming unfit for the purpoſes of hearing: The two apertures above-mentioned are in that part of the *Os Petroſum*, which conſtitutes the baſis of the labyrinth; the firſt is of an oval figure, and ſituated a little higher than the ſecond; *Vieuſſens* thinks this ſhould be called the *Feneſtra* of the labyrinth, becauſe it opens into the *Concha*, and conſequently into the more internal parts of the labyrinth; the baſis of the *Stapes* is applied to this *Feneſtra* and

ſhuts it, as long as the muſcles of the internal ear are at reſt; but on the contrary, when either of its muſcles is contracted, it opens it a little: The ſecond aperture, which is almoſt round, *Vieuſſens* calls the *Janua Labyrinthi*, becauſe it gives admiſſion into the ſmall and nearly round cavity, which leads to the labyrinth; for this cavity communicates not only with the extremity of the ſemi-oval ſpiral duct of the *Cochlea*, but likewiſe with the *Concha*, by a ſmall chink in its baſis, and conſequently with the ſemi-circular ducts hereafter to be deſcribed; the *Janua* is covered and cloſed up with a very thin ſmall membrane, which, by its curious texture, gives an eaſy admiſſion into the labyrinth to the æthereal matter, charged with the impreſſions of ſonorous bodies: Behind the *Janua Labyrinthi* is a ſmall cavity, by *Vieuſſens* called the *Veſtibulum primum*, and becauſe it leads to the *Cochlea* and *Concha*, by *Du Verney*, the *Veſtibulum Labyrinthi*; ſo that the three ſemicircular ducts of the labyrinth, together with the *Cochlea* are, as it were, its two apartments ſeparated from each other by the *Concha*, and yet at the ſame time communicating together by means thereof; and therefore *Vieuſſens* calls it the *Veſtibulum Secundum* of the labyrinth: That very fine membrane, which cloſes up the *Janua Labyrinthi*, expands itſelf into its *Veſtibulum Primum*, covers all its internal ſuperficies, and conſequently cloſes externally the ſmall chink in the baſis of the *Concha*, together with the extremity of the *Cochlea*; ſo that it adheres to theſe very fine nervous membranes which cover the internal parts of the *Cochlea*, and *Concha*, and by their means communicates with the *Portio Mollis* of the ear.

The *Veſtibulum Secundum*, which is the ſame with the *Concha* of ancient anatomiſts, is much larger than the *Veſtibulum Primum*; its cavity, which is nearly round, is about two lines in diameter; ſo that in adults it may contain about two grains of wheat, when divided into three or four parts, as *Vieuſſens* tried ſeveral times; in it are obſerved nine apertures, *viz.* two ſmall, and almoſt imperceptible *Foramina*, which receive two ſmall branches of the *Portio Mollis* of the ear; again, there is a pretty long chink in its baſis, and ſomewhat winding; and an oval aperture in that ſide, which regards the cavity of the *Tympanum*, called by ancient anatomiſts *Feneſtra Ovalis*; and laſtly, the mouths of the three ſemi-circular ducts, which are only five in number; for the ſuperior ſemi-circular duct, in that place where it regards the poſterior parts of the head, is ſo united with the inferior ſemi-circular duct, as that both open by one common aperture into the interior parts of the *Concha*; for which reaſon *Vieuſſens* calls it,

as

as modern anatomiſts do, the *Porta Communis:* All the apertures or mouths of the three ſemi-circular ducts are of ſuch a ſhape as to reſemble in ſome meaſure the extremity of a trumpet; and upon carefully tracing the cavity of theſe ſemi-circular ducts, it plainly appears to the naked eye, that from the middle it grows inſenſibly larger towards both its extremities; theſe mouths are ſo diſpoſed, as that two of them poſſeſs the upper, and two the lower part of the *Concha*; and the fifth is ſituated pretty near the ſmall chink in the baſe of the *Concha:* On that ſide of the *Secundum Veſtibulum Labyrinthi*, which regards the external parts of the head, there are three ſmall round canals, which, as they are inflected into a ſemi-circle, *Vieuſſens* with modern anatomiſts calls ſemi-circular; and the better to diſtinguiſh theſe canals, he gives them different names according to their different ſituations; the firſt he calls the ſuperior, becauſe it ſurrounds the arched roof of the *Concha*; the ſecond, the inferior, becauſe it encompaſſes its lower parts; and the third, as being ſituated between both he calls the middle canal: The ſuperior ſemi-circular duct, as ſoon as it comes out of the *Veſtibulum*, tends upwards, and in its way is gradually inflected into itſelf; and after it has deſcribed ſomething better than a ſemi-circle, and ſtill bending a little, has reached the poſterior part of the *Os Petroſum*, it joins the inferior canal; the inferior ſemi-circular duct ariſes from the lower part of the *Concha*, and having deſcribed ſomething better than a ſemi-circle, it joins the ſuperior ſemi circular duct, as was juſt now ſaid; ſo that both theſe ducts plainly become one, which extending itſelf obliquely, terminates in the *Porta Communis*: The middle ſemi-circular duct has two diſtinct orifices, and forms no more than a ſemi-circle: Theſe ducts have a very ſmooth internal ſuperficies and are for the moſt part round internally, and ſometimes oval: In that ſide of the *Veſtibulum Secundum Labyrinthi*, which is oppoſite to the three ſemi-circular ducts, and regards the internal parts of the ſcull, nature has placed the other apartment of the labyrinth, called *Cochlea*; and this *Vieuſſens* divides into two parts; the firſt retains the name of *Cochlea* and has a cavity, which can eaſily admit of a large lentil; the other part is called the ſemi-oval ſpiral duct: Upon removing that branch of the *Portio Mollis* of the ear, which is ſpread over the *Cochlea*, there is a bony ſubſtance, growing to the middle of its baſis, about a line in length, diſpoſed ſpirally, and which in ſome meaſure is pyramidal, and therefore called the *Nucleus Pyramidalis Cochleæ*; this *Nucleus* about the middle of its lateral part, which regards the internal parts of the ſcull,

reſts upon a thin, pellucid, and bony *Lamina* or plate, which partly conſtitutes the brim of the orifice of the *Ductus ſemi-ovalis ſpiralis*; and partly the internal ſide of the ſecond winding of the *Lamina ſpiralis*, which ſurrounds the *Nucleus*; ſo that that ſecond winding of the *Lamina ſpiralis*, is partly bony and partly nervous: In the middle of the *Nucleus pyramidalis* is a very thin bony prominence, found in adults, of an orbicular form, and about $\frac{1}{4}$ of a line in breadth, which adheres to the internal ſuperficies of the cavity of the *Cochlea*, and therefore *Vieuſſens* calls it the orbicular *Apophyſis* of the *Cochlea*; there is but one *Cellula* in the middle of the bone, which forms the extremity of the *Cochlea*; beſides, the whole interior ſuperficies of the *Cochlea* is very ſmooth, and when viewed by a microſcope, it appears perforated with ſeveral very ſmall *Foramina*, eſpecially in that part, which borders on the baſis of the *Nucleus pyramidalis:* The ſecond part of the *Cochlea* is the ſemi-oval ſpiral duct, which extends from its baſis, where this duct takes its riſe, to the ſuperior part of the *Veſtibulum Primum* of the labyrinth, and reaches to the ſmall chink in the baſis of the *Veſtibulum Secundum*; its cavity is formed in ſuch a manner, as to become a ſemi-oval ſpiral, and be ſomewhat broader at its termination, than its beginning; upon removing that branch of the *Portio Mollis* of the ear, which is ſpread thereon, there is obſerved in it a very ſlender bony proceſs, which extends from the internal ſide of the baſis of the *Nucleus Pyramidalis* of the *Cochlea* to its extremity; this *Vieuſſens* calls from its ſmallneſs, the bony line of the ſemi-oval ſpiral duct of the *Cochlea*. The *Portio Mollis*, or ſoft branch of the ſeventh pair of nerves is thicker than the *Portio Dura*, or hard branch, tho' it receives much fewer medullary fibres from the *Proceſſus annularis*, as it enters the internal duct of the ear, it is divided into three ſmall ramifications; *viz.* the ſuperior, inferior, and the middle; the ſuperior enters the cavity of the *Concha* thro' a peculiar *Foramen* cut out in its upper part, where it ſpreads itſelf into an exquiſite fine ſoft membrane, which lines its whole ſuperficies, excepting one fibril which ſtill retains the form of a ſmall nerve, and which lies upon, and adheres to, the ſmall and ſomewhat acute bony *Apophyſis*, in the internal edge of the above *Foramen*; this ſmall, ſoft, and fine nerve, is cloſely accompanied with its little artery and vein; when it leaves the bony *Apophyſis*, it runs along the middle of the cavity of the *Concha* like a ſtretched ſtring, and extends to the ſide of the *Porta communis* of the ſuperior and inferior ſemi-circular ducts, to which it adheres, and into which it afterwards enters, and then

then expands itſelf into two ſmall membranes; one of which lines the internal ſuperficies of the cavity of the ſuperior ſemi-circular duct, and the other the internal ſuperficies of the cavity of the inferior ſemi-circular duct: The inferior, and ſmalleſt ramification of the *Portio Mollis* of the ſeventh pair, upon ſending forth one or two, almoſt imperceptible fibrils, which are ſpread on that internal part of the *Os Petroſum*, wherein the ſemi-circular ducts of the labyrinth are excavated, enters a very ſmall *Foramen*, by means of which it inſinuates itſelf into the loweſt part of the *Concha*, and ſpreading itſelf therein, it is ſpent in forming that thin membrane, which as has been ſhewn above, lines the interior ſuperficies of the *Concha*, excepting a ſmall portion thereof, which enters the middle of the ſemi-circular duct, thro' a *Foramen* ſituated a little below the *Porta Communis*, and there it is expanded into a very thin ſmall membrane, which lines the internal ſuperficies of that duct: The fine and ſmall nervous membranes in the internal parts of the ſemi-circular ducts of the labyrinth are furniſhed with exceeding ſmall blood-veſſels, for the moſt part imperceptible; eſpecially, when they contain little or no blood; the membranes themſelves, as being furniſhed with a very limpid and ſubtile ſpirituous liquor, particularly in new-born children, are ſo ſoft, as hardly to bear touching; beſides, when expoſed to the ſun, they quickly dry up, and become ſo friable, that if moved out of their place, they crumble away, and are reduced into an impalpable powder; in like manner, that limpid ſpirituous liquor, with which theſe membranes are always furniſhed, and which ſeems to be no other than the animal ſpirits ſomewhat condenſed, by reaſon of the native coldneſs of the place, is diſſipated in a moment, as ſoon as the ſemi-circular ducts of the labyrinth are laid open, which in new-born children *Vieuſſens* always obſerved to be repleniſhed with this liquor; but the caſe would neceſſarily be otherwiſe, were not the five orifices of the ſemi-circular ducts of the labyrinth, which open into the internal parts of the *Concha*, naturally cloſed up by the nervous membrane above deſcribed; yet *Vieuſſens* does not at all doubt, but that this liquor gradually and inſenſibly inſinuates itſelf into the pores of the nervous membrane of the *Concha*, and prevents its being too much dried up; and hence it is, that it preſerves its native temperament, by which it contributes to the ſenſe of hearing.

The middle ramification of the *Portio Mollis* of the ſeventh pair of nerves ſends forth, near that part of the *Os Petroſum*, which

which is the basis of the *Nucleus Pyramidalis* of the *Cochlea*, several fibrils, which as soon as they enter the *Cochlea*, accompanied with their small arteries and veins, do there change their form, and are disposed and distributed in the following manner; and first, that thin membrane, which they receive from the *Pia Mater*, spreads itself in such a manner, as to terminate in a very fine small membrane furnished with innumerable blood-vessels, which at first lines the superficies of the base of the *Nucleus Pyramidalis* of the *Cochlea*, and all it contains, as far as the second winding of the spiral *Lamina* of the said *Nucleus*; afterwards it extends into the semi-oval spiral duct of the *Cochlea*, and is so expanded, as to shut up its extremity, and line all its superficies; as also, both sides of the semi-oval spiral *Lamina* which lies therein; and this membrane as being of a very fine and curious texture, does not hinder the continual and quick passage of the æthereal matter out of the *Tympanum* into the labyrinth and all its recesses; hence it is, that it was said above to enter into the labyrinth itself, thro' a cavity situated behind its *Janua:* As to the medullary substance of the nervous fibrils, one portion thereof is spent in forming the second winding of the spiral *Lamina*, which surrounds the *Nucleus Pyramidalis* of the *Cochlea*, the internal side of which winding is entirely bony, as was abovementioned; the other portion does at first form the beginning of the same *Lamina*, which only consists of half a winding, and is entirely nervous, and then extending to the semi-oval spiral duct of the *Cochlea*, it terminates in a nervous semi-oval spiral *Lamina*, which is situated there, and which by its thick part adheres to the bony line of this duct, so that the beginning of the spiral *Lamina* of the *Nucleus Pyramidalis* of the *Cochlea* is also that of the semi-oval spiral *Lamina*, just now described; which last, extending to the extremity of the semi-oval spiral duct wherein it lies, adheres by its sharp extremity to the middle of the small chink in the base of the *Concha*, and so divides that duct into two parts, between which there is no visible communication; and these two parts are disposed in such a manner, that the first, which regards the interior parts of the head, communicates with the *Vestibulum primum & secundum* of the labyrinth; but the second, which regards the *Tympanum*, and consequently, the external parts of the head has a communication with the *Concha* only: The middle ramification of the *Portio Mollis*, or soft branch of the seventh pair of nerves, after it sends out the small fibrils already described, enters a small

Foramen

Foramen within the middle of the *Nucleus Pyramidalis* of the *Cochlea* accompanied with a ſmall artery and vein; and as ſoon as it comes out of that *Foramen*, its fine membrane is expanded in ſuch a manner, as to line what is contained between the ſecond winding of the ſpiral *Lamina*, of the *Nucleus Pyramidalis* of the *Cochlea*, which is partly bony, and partly nervous, to the extremity of the *Cochlea* itſelf; its medullary ſubſtance terminates in the third winding of the *Lamina Spiralis*, which is entirely nervous, and the circumference of this winding reſts upon, and adheres to, the orbicular *Apophyſis* of the *Cochlea*; and at laſt, its extremity is expanded into a ſmall membrane, which being rolled up a little, is applied and adheres to the edge of the *Cellula*, excavated in the middle of the extremity of the *Cochlea*, and ſo forms a ſmall cavity, reſembling a little cloſe cup.

From what has been ſaid it appears that the ſpiral *Lamina* within the *Cochlea*, conſiſts only of two windings and a half, which are diſtinguiſhed from one another by ſmall cavities repleniſhed with innate air, and between which there is no viſible communication: Here it is to be obſerved that the ſpiral *Lamina* ſurrounding the pyramidal *Nucleus* of the *Cochlea*, as alſo the ſemi-oval ſpiral *Lamina*, within the ſemi oval ſpiral duct of the *Cochlea*, together with the ſmall nervous membranes that line the internal ſuperficies of the three ſemi-circular ducts, are furniſhed with a very limpid ſpirituous liquor, particularly in new-born children, which upon laying open the *Cochlea* becomes viſible to the naked eye, and ſoon evaporates; the interior or medullary, and truly nervous ſubſtance of the ſaid *Laminæ* is ſoon dried up, and becomes very friable when expoſed for any time to the air, as was above obſerved: From what has been ſaid of the *Portio Mollis*, or ſoft branch of the ſeventh pair of nerves, *Vieuſſens* thinks it plain, that the above deſcribed two nervous ſpiral *Laminæ*, together with thoſe of the *Concha*, within the three ſemi-circular ducts, conſtitute the immediate and complete organs of hearing; ſo that according to the different motions excited by the objects of that ſenſe in the animal ſpirits, lodged in their pores, and communicated to the common *Senſorium*, different ideas of ſound are produced in the mind.

An Argument for the Use of Laryngotomy, *by Dr.* William Musgrave. Phil. Trans. N°. 258. p. 398.

LAryngotomy is highly to be valued, because that in the greatest extremity, where a person is in most imminent danger of suffocation, and to all appearance within a very few minutes of his last, by opening a new passage for the breath, it gives speedy and certain relief, and that, when all other methods fail, and without any considerable injury from the instrument. That laryngotomy may be put in practice in dangers of suffocation, and that the wound is curable will appear by the following case, communicated to Dr. *Musgrave* by Mr. *Keen*.

Nicholas Hobb of St. *Enodor* in *Cornwal*, aged 63, or thereabouts, was set upon by ruffians, who first by a blow on the *Occiput*, knocked him down to the ground, then cut the *Trachea* or wind-pipe through, somewhat beneath the *Pomum Adami*, together with several of the adjacent muscles, and some large blood-vessels, from which he lost a vast quantity of blood; and so the ruffians left him; after some time, the wounded man recovered so much sense and strength, as to thrust his neck-cloth into the large gaping wound, and by degrees crawl home; lipothymies or fainting fits came frequently upon him, especially upon every the least motion of his body; these were after some time succeeded by convulsions: Mr. *Keen* the surgeon having examined the wound, found that the parts of the *Trachea* were at a great distance from each other, the lower part being on every turn of inspiration sunk deep into the neck as low as the *Claviculæ*, and just appeared upon every exspiration: The surgeon directed a lusty strong fellow to hold the legs of the patient over his shoulders, and by this means raise them together with the *Abdomen*, above the *Thorax*, *Collum*, *&c.* in which posture the divided parts came so near to each other, that with strong waxed thread he sewed together several of them; but as to the divisions of the *Trachea*, he joined them, by passing large needles deep into the flesh on each side, and twisting strong waxed thread about them, as in *Labio Fisso*; over all, for the greater security he applied a restrictive, *ex Pulv. restring.* Clowes; covering the greatest part of the neck with a defensative *ex Bolo cum albumine ovor.* advising the patient to lie as quiet as he could; the patient now began to speak softly and with a low voice, as the cough, difficulty of breathing and his weakness would allow: Then an arteriac

was

was made up for him, to ſmooth the *Trachea* and promote expectoration, viz. *℈ Troch. Pectoral. Batean. in Aq. Staphan.* ℥ *ſs Solut.* ℥ iij. *Syr. Tuſilag.* ℥ i *ſs. Balſamic.* ℥ i. *Pulv. Anis. Glycyr. ana*; ℥ i. *Balſam. Sulphur. Terebinth.* ℥ *ſs. Peruv. Gut.* ʒ j. *cum mellis opt. deſpumat. q. ſ. fiat Linctus per Bacillum Glycyr. ſepius. adhibend:* From the uſe of this the patient's cough abated, and he expectorated much grumous blood and other matter; as to the convulſions and lipothymies the ſurgeon applied to his noſtrils *Spir. C. C. Succin.* &c. and embrocated the back part of his neck with a liniment *ex ol. Lil. alb.* ℥ i. *Tereb. Succin. ana* ℥ i. *N. M.* ℥ *ſs. Ung. Nervin.* ℥ ʒ j. *miſ.*

The next day the convulſions left the patient, nor had he from that time any return of them or of the *Syncope*; but on the fourth day the ſtitches were broke open when the wound appear'd large enough to admit a middle ſized hand, a great part of the *Oeſophagus* appeared to view, being much inflamed and ſcratched by the ruffians inſtrument; the *Epiglotti's* did not as uſual, cover the *Rima* of the *Larnyx*, ſo that the ſurgeon could eaſily ſee up into the patients mouth; part of the annular cartilage was cut obliquely, and hung only by a ſmall fibre to the upper part of the *Larynx*; there were frequent ruptures, the waxed thread and needles often fretting thro' the fleſh they held; but the ſurgeon as often repeated the ſtitches in the ſame manner as before: About the 10th day, the largeſt blood-veſſels appeared conglutinated and covered with new fleſh, the *Gula* had a good aſpect, and the inflamation of that and all the neighbouring parts was gone off. The ſurgeon dreſſed now with *Liniment. Arcei*; on the 11th day the ſymptomatic fever was in a manner gone, and the wound under the circumſtances of a good digeſtion; in the mean time, his diet when he could ſwallow, was mutton-broth, medicated ale, and poached eggs; the cough continuing a long time very ſevere, was at length overcome by duly adhering to the uſe of the *Linctus* aforeſaid, with repeated boles of *Balſam. Lucatel. Conſ. Roſar. Rub. horâ ſomni*, with a draught of a pectoral decoction, which was alſo uſed inſtead of common drink, to mitigate the violence of the cough and procure him ſleep, the following draught was frequently uſed, and never failed. *R. Ol. Amygdal. dul. rec. expreſs.* ℥ *ſs. Syr. de Mecon.* ℥ vj *Laud. Lond. Aq. Steph.* ℥ ij *Solut. gr.* ij. *fiat hauſtus horâ ſomni ſumendus.* About the 11th and 12th days, there were plainly diſcovered little portions of new fleſh ariſing, not only from

the carneous membrane incumbent on the gullet, but alſo out of the ſubſtance of the cartilages themſelves, both on the upper and lower parts of the divided *Trachea*; the external, containing parts of the neck, began now to unite, new fleſh ariſing, and apparently leſſening the dimenſions of the wound, every time there was a laceration of the ſtitches, inſomuch that two needles were now ſufficient, whereas at firſt there were uſed no leſs than ſix; theſe carneous portions, both of the *Trachea* and exterior parts, gradually joining and intermixing, became one ſolid *Cicatrix* from each end of the wound, almoſt to the middle of the wind-pipe, where the air continued ſtill in ſome degree to have an exit; about the 15th day the ſurgeon removed ſeveral pieces of bone, which had contracted a *Caries* in the cartilage, which in this old man, as in ſeveral others, was grown bony, and were expelled by the new fleſh: At this time he ſwallowed with little trouble, eat ſufficiently, and was nouriſhed in proportion; the aperture was almoſt cloſed up about the 26th day, and in four or five days more, the ſides of the wound were perfectly joined and cicatriſed, the *Trachea* performing its part in reſpiration as at other times, without any conſiderable inconveniency; he afterwards ſpoke indifferently well, but was forced to take care when he ſwallowed, the *Rimula* not being ſhut exactly, as it was before this wound, which makes fluids of any ſort more apt to fall into the canal, and ſo cauſe a cough, hoarſneſs, *&c.* He did not ſwallow dry meats as eaſily as he did before but was in all other reſpects as well as ever.

The Pneumatical-Engine *applied to* Cupping-Glaſſes *by Mr.* Tho. Luffkin. Phil. Tranſ. N° 259. p. 408. *Tranſlated from the* Latin.

LET A B Plate XIII. Fig. 1. be a concave cylinder of braſs, of a proper thickneſs, an inch in diameter, and ten or twelve inches long, to be ſo exquiſitely poliſhed on the inſide, as not to have the leaſt flaw or inequality; let there be a ſmall bore near the bottom as O, and a cover or lid as E F Fig. 2. to be fixed on the cylinder by two ſcrews; a bottom as G H Fig. 3 to be ſoldered to the cylinder; let that end of the ſyringe 1 2, be perforated in the middle, to the outſide of the bottom; let the iron rod N N, Fig. 4 of a proper thickneſs, be fitted to the length of the cylinder; at its extremity let there be a plate of braſs L M, and about two inches from the top another plate I K; the intermediate ſpace is to be filled up with threads moiſtened in oil, ſo as to ſhut exactly

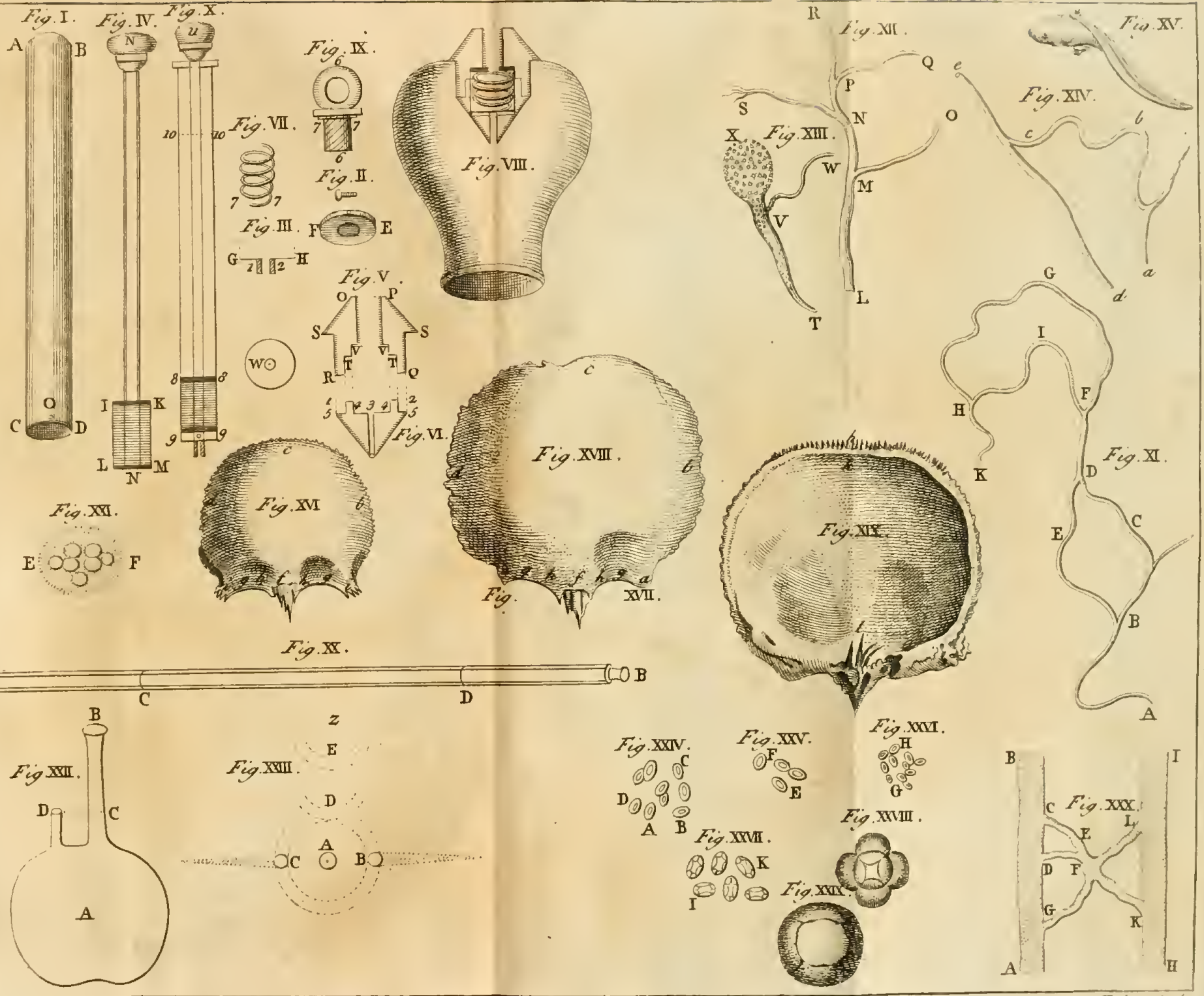
Fig. I.
Fig. IV.
Fig. X.
Fig. IX.
Fig. VII.
Fig. II.
Fig. III.
Fig. VIII.
Fig. V.
Fig. VI.
Fig. XII.
Fig. XV.
Fig. XIV.
Fig. XIII.
Fig. XI.
Fig. XVI.
Fig. XVIII.
Fig. XIX.
Fig. XVII.
Fig. XXI.
Fig. XX.
Fig. XXII.
Fig. XXIII.
Fig. XXIV.
Fig. XXV.
Fig. XXVI.
Fig. XXVII.
Fig. XXVIII.
Fig. XXIX.
Fig. XXX.

exactly the cavity of the cylinder; then let there be a handle as N: This engine compounded of all these parts, is not unlike a surgeon's syringe; let there also be made another cylinder of brass O P Q R Fig. 5 of the magnitude of the figure, with two *Alæ* or wings O S P S, and of such a bore, as that its inside being made into a female screw, it may be exactly fitted to receive the male screw; let the bore be enlarged from R and Q to T T; and let there be a shoulder V V: and make a plate W, perforated in the middle to fit the shoulder, and be fixed thereto; make a right cone bored thro' its axis 1 2 3, Fig. 6; enlarge the bore from 1 2, to 4 4; let there be a shoulder 5 5 to fit exactly the cavity of the cylinder T T, and be firmly fixed therein; let there be made a spring Fig. 7, of brass wire in a spiral form round the cylinder, of a proper elasticity, and nearly equalling the diameter of the box 4 4 V V; but a little higher than the box, when left to itself; let it have at its lower extremity the plate 7 7 of the same magnitude, whose inferior part is to be armed with a soft leather moistened in oil, to shut the orifice of the syringe; then at the top of the cupping-glass Fig. 8, let there be a round bore, by which the cone is let down as far as the *Alæ* S S; let the chinks or fissures be filled with cement made of rosin, turpentine and lime, then let the lid 6 7 6 7 Fig. 9, be wrapped up in leather steeped in oil as high as the shoulder by which the air, when exhausted out of the glass (should there happen to be any fissures in the little valve) may be excluded: When the thumb is applied close to the bore, the plate 9 9 Fig. 10, is raised by the handle to 10. 10; but because at first the air only filled the space 9 0 9, it is now so rarified, and expanded, as to take up the space 9 9. 10. 10. which is 300 times greater than the former; wherefore the elasticity of the air included in the glass, exceeding both the elasticities of the spring, and of the air contained in the cylinder, the plate or valve will be thrust upwards, which will continue open, till such a quantity of air gets into the cylinder out of the glass, as that the elasticity of the complement of air contained in the glass shall be equal to both the elasticities of the spring and of the air now contained in the cylinder; and upon opening the bore O, the valve J is strongly shut by the pressure of the external air; *cæteris paribus*, upon three or four suctions, more or less, $11\frac{222}{300}$ parts of air (according to the power of the spring, and the ratio between the capacity of the cylinder and that of the cupping-glass) will be exhausted; and

if the elaſticity of the air in the ſame ſpace be as its quantity, the reſiſtance or preſſure under the glaſs will be to the preſſure upon the circumjacent parts, as one to a thouſand; becauſe, before the air was exhauſted out of the glaſs, the reſiſtance or preſſure under the glaſs was the ſame with that upon the parts without the glaſs: Mr. *Luffkin* takes it to be worth obſerving, that by how much greater the cylinder is, than the ſpring, ſo much greater will the quantity of air be, that is exhauſted out of the glaſs; becauſe the air 9, 0, 9 is expanded into a greater ſpace, and conſequently has a leſs elaſticity; wherefore the elaſticity of the air in the glaſs has a greater ratio to the elaſticity of the air contained in the cylinder and ſpring, and for that reaſon a greater quantity of air will be exhauſted out of the glaſs.

Two monſtrous Pigs *and a monſtrous double* Turkey; *by Sir* John Floyer. Phil. Tranſ. N° 259. p. 431.

THAT the diſtortion of the parts of a *Fœtus* may occaſion its repreſenting the figure of different animals, without any real coition betwixt the two ſpecies, appears by the deſcription of the following monſters: There was ſhewed Sir *John* a pig at *Weedford* in *Staffordſhire*, with a face ſomewhat reſembling that of a man; the chin was very like that of a human *Fœtus*; the roundneſs of the head, and flatneſs of the ears was ſurpriſing; but upon carefully viewing the head, Sir *John* obſerved there was a depreſſion of the bones of the noſe; in that place which was betwixt the eyes, in which the pig's face ſeemed to be broken, and the noſe drawn up, to appear like human; the under-jaw was inverted, growing up to meet the upper; the tongue and mouth were more like the human, being altered by ſome external preſſure upon the pigs mouth, which broke the bones of the noſe, and cauſed their depreſſion towards the palate, and the inverſion of the under-jaw; this preſſure upon the mouth forced the bones upwards, ſo as to cover the orbits of the eye and the pig appeared blind: The depreſſed bone ſhut itſelf with a ſpring when forcibly opened, ſo that it had been cloſed up, ever ſince it was cartilaginous; by this breach or depreſſion of the pigs face, Sir *John* was firſt convinced that this monſter was not produced by the copulation of two ſpecies, but only occaſioned by ſome compreſſion or other; and that the pig's head was ſtraitened in its growth, appeared by the flatneſs of the ears; and that this depreſſion happened, whilſt the bones were cartilaginous, appeared by the depreſſed bones remaining cartilaginous, and at the ſame time the under-jaw was inverted and the head became more

round.

round: He farther obſerved, that all the head was covered with hair, as the other pigs were; that it had pigs teeth; the hair of the pigs head was yellow, as that of the ſow was; the monſtrous pig was as big and as well grown, as the reſt of the pigs; it had a pig's ſnout, and there was no upper lip, as in the human kind, in all the other parts, it appeared to be a perfect pig, no parts being wanting but thoſe of the face which were diſtorted by ſome external accident; 17 weeks after the ſow took boar, which is the uſual time, ſhe pigged eight pigs, the firſt five were perfect, the ſixth was the monſter, and after that two more perfect pigs; this monſter was pigged alive, but died becauſe it could not ſuck, the noſe being ſtopped; and for this reaſon, and becauſe of the alteration of the figure of its mouth this pig's cry was not like the others; all which further convinced Sir *John* that there really was no mixture of two ſpecies in this monſter: This kind of monſtrous pigs, produced by the unnatural ſituation of the parts by ſome external compreſſion, Sir *John* thinks, are very frequent, having had another of the ſame kind ſent him out of *Derbyſhire*, which had the reſemblance of a human face, the chin, the depreſſion betwixt the eyes, the roundneſs of the head and flatneſs of the ears, as above deſcribed, and all its other parts like a pig, only that it was without any hair, as untimely pigs commonly are, and no ſex could be diſtinguiſhed therein.

At *Thorpe* in *Staffordſhire*, two turkeys were taken out of an egg (of the ordinary ſize) when the reſt of the eggs were well hatched; they grew together by the fleſh of the breaſt-bone, but were diſtinct in all other parts; they ſeemed leſs than ordinary turkeys; for there wanted both nutriment, and room for their growth, which was the occaſion of their coheſion and ſmallneſs; they had diſtinct cavities in their bodies, and two hearts; ſo that they had two diſtinct *Cicatriculæ* or treddles, and conſequently the egg from whence they were produced had two yolks in it, which accident is very common: But Sir *John* had a dried monſtrous chicken, which had but one head, four wings, four legs, one cavity in the body and conſequently but one heart; in this caſe this monſtrous chicken was produced from one *Cicatricula*; ſo *Paræus* mentions a double infant with one heart; in theſe caſes the original of the infant was one and the veſſels regular; but in the extreme parts the arteries and nerves were divided into more branches than ordinary, and produced double parts; and thus it is like the double flowers of plants, which are produced by the richneſs of the ſoil; as the two yolks in an egg are joined in the *Ovarium* and covered with one ſkin, ſo it is in the eggs of

of quadrupeds, they are alſo joined in the *Ovarium*, and as they grow, their bodies cohere externally; ſo that Sir *John* obſerves, that there are theſe two reaſons for the multitude of parts in an *Embrio*, *viz.* the joining of two perfect animals, or elſe the extraordinary diviſion of the original veſſels, the arteries and nerves.

An Account of Maryland; *by Mr.* Hugh Jones. Phil. Tranſ. N° 259. p. 436.

Cheſepeak-bay, which runs N. and by W. about 200 miles or more, divides *Maryland* as well as *Virginia* into two parts, which are called the eaſtern and weſtern ſhores; the whole province contains 11 counties, 6 on the *Maryland* ſide, which is the weſtern, and 5 on the eaſtern ſhore; the land is generally low on both ſides; there is no hill, that Mr. *Jones* could learn, 50 yards perpendicular height; but about 100 miles weſt towards the heads of the rivers, the ground riſes, and appears in very high mountains, and rocky precipices, running north and ſouth; from the top of which there is a clear proſpect of *Virginia* and *Maryland*; all the low land is very woody, like one continued foreſt, no part cleared but what the *Engliſh* have done in that reſpect; and tho' the inhabitants are ſeated pretty cloſe, yet they cannot ſee their next neighbour's houſe for trees; in time it may be otherwiſe; but as the tobacco trade employs a great deal of timber, both for making of hogsheads, and building tobacco-houſes, and that the ground is cleared yearly for planting, the number of woods may in time be leſſened: The ſoil is generally ſandy, and free of ſtone, which makes it very convenient for travelling: As to the natural ſituation of the country; the number of navigable rivers, creeks, and inlets, render it very convenient both for exportation and importation; the rich and plentiful gifts of nature likewiſe add to the happineſs of the place; the three elements affording plenty of food for the uſe of man; and for the preſervation of health many excellent herbs and roots, the diſcovery of whoſe virtues are chiefly owing to the *Indians*; as for timber, there are ſeveral ſorts of oak, *viz.* the red, white, black, cheſnut, water, *Spaniſh*, and line oaks, which laſt bears a leaf like a willow; there is alſo a white and red cedar; the red ſerves only for poſts and groundſils; the white is for making plank, that being the freeſt from knots; there is a tree called cypreſs, which is extraordinary large in bulk, and bears a leaf like the ſenſitive plant; it is ſoft and ſpongy, will not ſplit, and is fit for no uſe; here they have black-walnut, which

which is greatly eſteemed by the joiners for its grain and colour; here is a ſort of poplar that makes good white plank; it is a large tree, and bears a flower like a tulip; here is alſo plenty of pine and dog-wood, which bears a fine flower; ſaſſafras and locuſt, is a tree of very quick growth, and very durable in building; of hickory, there are two ſorts, red and white; this chiefly ſerves for faggots, being the beſt for that uſe; here are alſo plenty of cheſnuts and chinquapine which is a ſpecies of it, and a ſort of elm like a *Dutch* elm, called the ſugar-tree, from the ſweetneſs of its juice, with which ſome have made good ſugar; here is alſo a ſort of elder, whoſe bark is cloſely defended with prickles like thoſe of a briar; alſo laurel-bearing tulips and myrtle of ſeveral ſorts, one whereof bears a berry, with which on the eaſtern ſhore they make green wax, very proper for making candles, when mixed with tallow: Of birds, which are very numerous here, the moſt curious are the humming-birds; they continue all ſummer, feeding only on flowers like bees; and the mocking-bird, which exceeds all others in the world for the variety of its notes; of reptiles, the rattle ſnake is the moſt noted; and what is commonly reported of its charming birds, and ſquirrels, *&c.* is not groundleſs, it being confirmed to Mr. *Jones* by ſeveral eye witneſſes: The air is become more wholeſome here than formerly it was, which no doubt proceeds from the opening of the country, which gives the air a freer motion; the ſummers here are not extreme hot, as they were at firſt, but the winters are generally ſevere, compared with what they are in *England*; the north-weſt wind is very ſharp in winter, and even in the heat of ſummer it very much cools the air; and often at that time a ſudden north-weſt wind ſtrikes the labourers into a fever, if they are not careful to provide againſt it, and put on their garments while they are at work: There are little or no woollen or linen manufactures here, excepting what is made in *Somerſet* county over the bay; becauſe they are yearly ſupplied from *England*; tobacco is their grand commodity, being the ſtandard for trade, not only with the merchants, but likewiſe among the inhabitants themſelves; the common drink is cyder, which is very good, and when it is duly ordered, not inferior to the beſt white wine; they have wine brought from *Madera* and *Fayal*; rum from *Barbadoes*; beer, malt and wines from *England*; here is plenty of grapes, growing wild in the woods; but there is no improvement made of them.

In *Maryland* they are governed by the ſame laws as in *England*, only that there are acts of aſſembly relating to ſome particulars

cular caſes, not under the verge of the *Engliſh* laws, or where the laws of *England* do not ſo aptly provide for ſome circumſtances; the church of *England* is pretty firmly eſtabliſhed amongſt them; churches are built, and an annual ſtipend allowed every miniſter by a perpetual law, which is more or leſs, according to the number of taxable perſons in each pariſh; every Chriſtian male of 16 years old, and negroes male and female above that age, pay 40 pounds of tobacco to the miniſter, which is levied by the ſheriff amongſt other public taxes, and makes the revenues of the miniſters one with another, about 20000 pounds of tobacco, or 100 *l.* ſterling *per annum.*

Upon the firſt ſettling in *Maryland* there were ſeveral Nations of *Indians* in the country, governed by ſeveral petty kings; but their numbers were afterwards much diminiſh'd which was owing to their civil wars: They take delight in nothing elſe but hunting; and it is rare that any of them embrace either the worſhip or way of living of the *Engliſh*: There is one thing obſervable of them, that tho' they are a people very timorous and cowardly in fight, yet when taken priſoners and condemned, they die like heroes, braving the moſt exquiſite tortures, and ſinging all the time they are upon the rack.

The Circulation and Stagnation of the Blood in Tadpoles; *by* M. Leewenhoek. Phil. Tranſ. N° 260. p. 447.

M. *Leewenhoek* had tadpoles of ſeveral ſizes; the biggeſt were arrived to ſuch a magnitude, that their hinder legs ſtuck out from their bodies; and 30 of the ſmalleſt were together only equal to one great tadpole; hence he concludes, that frogs lay their eggs but very ſlowly; for it was already about a month's time ſince he had made his obſervations, when he judged that ſome of them were half grown: The firſt obſervation he made of the motion of the blood was in a ſmall veſſel, which was ſomewhat wider than to admit a red globule of blood, as A and B, Plate XIII. Fig. 11. this veſſel, which is called an artery, and thro' which the blood coming from the heart from A to B is impell'd with great ſwiftneſs, divides itſelf at B into two branches, as B C, and B E; theſe two branches united again at D, where they continued united but a little way, as is ſhewn by D F, and from this they divided again into two branches F G and F I; theſe two branches ran crooked, and were united at H, where they made a ſomewhat larger veſſel, as H K; where at K, it became a bigger veſſel; for which reaſon, we muſt call the blood-veſſels A B C D F G, and A B E F I arteries, becauſe they convey the blood from the heart; and

and the blood-veſſels G H K and I H K veins, becauſe they return the blood to the heart again; in another place M. *Leewenhoek* ſaw the blood moving in an artery, which was ſo large, as to admit about 20 of theſe red globules at once; this was a great artery in compariſon of theſe abovementioned, and in this the blood mov'd very ſlowly, a ſmall portion whereof is delineated as L M, Fig. 12. out of this blood-veſſel proceeded a leſſer, as M O; the blood in the veſſel from L to M had not ſo quick a motion, as it had in others, becauſe the blood in the veſſel at R did in a manner ſtagnate, inſomuch that no ſeparated parts could be diſcerned in the blood, for it appeared there of one uniform red colour, yet in the blood-veſſel M O the circulation was as ſwift, as in any other veſſel; that the blue ſpots occaſioned by a fall or bruiſe is not ſtagnated blood, which before it begins to corrupt, perſpires thro' the ſkin together with the ſweat, M. *Leewenhoek* was convinced by the following obſervation; the blood at R being thus without the leaſt motion, it was by every pulſation of the heart impelled upwards, from N to P, and the next moment it recoiled back again, and thus backwards and forwards with an undulatory motion; as is known, if we uſe never ſo much violence in preſſing water, yet we cannot preſs it cloſer than it was before; ſo the blood being now impelled forwards through the heart, cannot be compreſſed into a leſs ſpace; this being ſo, we muſt conclude, that the tunic of the blood-veſſels between N and P, and alſo ſomewhat below N, is diſtended by every pulſation of the heart; and as ſoon as this uncommon diſtenſion is performed, ſo ſoon alſo does the tunic of the veſſel contract itſelf again, whereby the blood that was thus puſhed forwards, is forced to run back again: M. *Leewenhoek*, after ſome time, obſerved the blood begin to move from P to R after ſuch a manner, as to be puſhed back again, and he alſo judged that the blood-veſſel marked M O was during his obſervation a little more extended, and by conſequence more blood ran thro' it, than when he firſt began to look upon it; the blood in the veſſel N S, wherein there was little or no motion before, did now run as ſwift, as it did in any other veſſel; the blood-veſſel P Q, which was ſo ſmall, that but one ſingle particle of the blood could paſs through it at once, and wherein at his firſt viewing it there was not the leaſt motion to be diſcerned, now alſo began to flow; yet the particles of the blood, that at firſt paſſed through it, were but few in number, and conſequently far aſunder; further all the blood from P to R was put into motion, as well by being puſhed forwards, as by recoiling back again, and that at every pulſation of the heart: In theſe obſer-

vations M. *Leewenhoek* ſpent about two minutes; ſo that now it plainly appears to the naked eye, that the ſtagnated blood cannot only be made to move again by the motion of the heart, which we call the beating of the pulſe, but alſo that the coagulated red globules are again diſſolved, and aſſume their firſt figure; and therefore there is reaſon to conclude that the coagulated blood in any animal, occaſioned by a blow or bruiſe, can in a few days be made to move again, it being taken for granted, that the heart of a man puſhes out the blood 75 times in one minute, which is 4500 times in one hour, and 108000 times in the ſpace of a day and night: Now finding that in 14 days time the coagulated blood ſeemed to vaniſh, and alſo conſidering that in this time the heart performs its pulſation 1080000 times, and that in each motion into ſeveral veſſels together, there has been looſen'd and ſet a-going the quantity of a grain of ſand, how much more may be ſet a-going in the time beforementioned: M. *Leewenhoek* could ſee in the blood-veſſel abovementioned at each impulſe, the blood received from the heart; now if we ſuppoſe that the quantity of a cubic inch of coagulated blood occaſioned by a blow, is too much, and that ſeldom ſo much is coagulated at once, then we may eaſily underſtand that ſuch coagulated blood, by means of ſo many motions as are abovementioned, may be looſened, and its motion reſtored again, if not in all, yet in moſt of the veſſels.

At another time M. *Leewenhoek* laid one of theſe tadpoles on a piece of clean paper, for a little while before he came to look upon it, a ſmall part of the tail came to be wounded, the ſkin being dry ſtuck to the paper, ſo that out of an artery, in the excoriated part, which M. *Leewenhoek* judged to be ſo large that four red globules of the blood could paſs through it at once, there flowed ſome blood, which remained without motion about the wounded part; yet that whereon his eye was fixed, not being half a hair's breadth from the excoriated artery, there proceeded a ſmall branch of a vein, wherein the circulation of the blood did ſtill remain, as if the artery had not been broken. Fig. 13.

T V repreſents the artery wounded a little above V; V X ſhews the extravaſated blood; V W the ſmall artery, wherein the blood retained its full courſe, altho' it was ſo near the vein T V, out of which the blood flowed and was extravaſated; this at firſt ſeem'd ſtrange to M. *Leewenhoek*; but upon obſerving that the blood-veſſel V W was united at W to a large blood-veſſel that conveyed the blood to the heart, then this blood out of V W was carried on with ſo great ſwiftneſs, as if impelled from T to V; nay, in ſuch a manner, that M. *Leewenhoek* imagined, that if the

the vein at V had not been united with T, but had only lain with its aperture at V in the extravaſated blood, ſo that the extravaſated blood was only for a little ſuckt up and conveyed thro' it: Then M. *Leewenhoek* ſaw a vein, wherein the motion of the blood ſeemed very uncommon, as for example, let Fig. 14. *a b* be an artery, wherein the blood is impelled with great velocity from *a* to *b*, then *b c*, whereby the blood is conveyed towards the heart, muſt be called a vein; and cloſe by it lies another artery *d c e*, thro' which the blood was conveyed from the heart from *d* to *c*; now if the vein *b c*, be united with the artery *d e*, as is ſeen at *c*, and thus the blood be conveyed from *c* to *e*, *b c* ſhould be called a vein, and the blood coming to *c*, and being there transfuſed into *c e*, is the arterial blood, becauſe it is conveyed thither from the heart, it being certain that *d c e* is an artery.

Amongſt the reſt M. *Leewenhoek* had a tadpole before him, wherein he could perceive no motion at all of the blood, how attentively ſoever he viewed it, whereof at firſt there appeared no reaſon, 'till upon contemplating this animal with the naked eye, he obſerved that the fore-part of its body was contracted, by which he imagined that the heart was oppreſſed, ſo that it could not force out the blood, and receive it back again; whilſt he was conſidering this, the little animal made a very ſtrong motion, beating its tail about, and bending its body, by which it got clear of the oppreſſion it was under; and upon viewing it again, he immediately perceived that the blood began to have a ſlow motion and impulſe in ſeveral veſſels, which increaſed ſo, as at length to come to its proper motion, yet not with ſuch velocity, as it would have had, if either the heart or body had not been oppreſſed: The motion of the blood in theſe tadpoles exceeds what M. *Leewenhoek* ever ſaw in any ſmall animal. Fig. 15. repreſents a tadpole arrived to ſuch a bigneſs, as that it could uſe its hinder legs; and the fore-legs were alſo diſcernible, but yet covered with the ſkin; at laſt M. *Leewenhoek* eſpied an artery, that tho' it was ſo ſmall, as that he judged that one little globule of blood could paſs through it, yet out of ſuch a branch there ſtill proceeded two other branches, in each of which the blood flowed, yet farther aſunder and ſlower, than it had done before it came into the ſeparated veſſels; after this he fixt his eye upon the great artery and vein, which were ſo cloſe to each other, that there was not above the diſtance of the fourth part of the breadth of a hair between them; and it happening that the animal, whilſt he viewed it, moved its head upwards, and tail downwards, the blood run upwards in the artery and downwards in the vein, and

that with an equal velocity; yet, what was moſt remarkable was to ſee the manifold ſmall arteries, which proceeded from the great one, ſpread into ſeveral branches, and returning, unite again in one, which at laſt poured the blood into the great vein: Theſe particles of the blood, are, according to M. *Leeuwenhoeck*'s poſition, ſo exceeding ſmall, that ten hundred thouſand of them cannot make up a body as big as a large grain of ſand; and from thence may be conjectured, that ſuch ſmall veſſels have branches and channels; with which if they were not provided, the blood-veſſels in the thinneſt part of the tail, where they meet, would not lie croſs one another, but muſt unite, which he never obſerved.

A Bodkin *cut out of a* Woman's Bladder; *by Mr.* Proby. Phil. Tranſ. N° 260. p. 455.

DORCAS *Blake* of *Dublin*, a luſty young woman, of a ſanguine complexion, and about 20 years old, being much troubled with a hoarſneſs, was very deſirous to take a vomit for it; to which her friends not conſenting, ſhe endeavoured to provoke vomiting by thruſting her finger into her throat; but that neither anſwering her deſire, ſhe drew an ivory bodkin four inches long, out of her hair, and thruſt the ſmall end forwards into her throat; upon which ſhe heaved ſo often, as to be out of breath, and was obliged to ſtand upright to draw ſome air; which ſhe did without taking the bodkin out of her throat, and at that inſtant it ſlipped out of her fingers into her ſtomach; ſhe found no immediate inconveniency, but next day about noon, ſhe felt a ſharp pricking pain in the right ſide of her belly, lower than the navel; towards evening ſhe felt a pain nearer her right groin than before, which obliged her to go to bed, where ſhe lay reſtleſs all that night, by reaſon of the exceſſive pain: A midwife ſearched her, and ſaid, ſhe felt the end of the bodkin, but thought it was in a gut; at night Mr. *Proby* was ſent for, and in ſearching her by the *Anus*, he could not find it; but putting his finger *in Vagina Uteri*, he felt the bodkin; and becauſe ſhe complained of a difficulty in voiding urine, he uſed his catheter, and he felt it as he thought, in the bladder; but immediately trying a ſecond time, he could not find it; within a fortnight after, it was very plainly to be felt; and in about ten days more, after duly preparing her body for the operation, he attempted to extract it, after the ſame manner as the ſtone from women; but having introduced his *Forceps* into the neck of the bladder, and

and very readily taking hold of the bodkin, yet he could not move it; he then preſſed his finger thro' the dilatation into the bladder, and tried to bring the whole bodkin into the bladder, but all in vain; nor could he turn it one way or other, but round like a ſpindle, the ſmaller end, reſting as he thought, upon the *Iſchium*; all his attempts this way proving fruitleſs, and her pain increaſing, he attempted to extract it in the manner of the higher operation for the ſtone; which was as follows, in the preſence of Drs. *Maddin*, *Molyneaux*, and *Smith*.

Having placed her in a convenient poſture, he put his finger into the *Vagina Uteri*, and felt the bodkin lying cloſe to it on the outſide; whilſt he held his finger there, he preſſed with his left hand above the *Os Pubis*, where he felt the head or thickeſt end of the bodkin; and Dr. *Smith* putting his finger into the *Vagina*, preſſed hard againſt the bodkin, and held it very firm and ſteady, whilſt Mr. *Proby* made an inciſion about an inch and a half in length, on the outſide of the right *Muſculus Rectus*, till he came to the bladder; he then paſſed his fore-finger and thumb into the wound, and got hold of the head of the bodkin (the ſubſtance of the bladder only interpoſing) upon which he cut the bladder with a ſmall crooked biſtory, and gently preſſing with his finger and thumb, the bodkin ſlipt out of the bladder between them, by which he extracted it very eaſily: he dreſſed the wound, and in leſs than a month, ſhe was perfectly cured: The bodkin was cut out of her bladder that day nine weeks ſhe ſwallowed it; there had been but half the bodkin in her bladder, which was incruſtated with a gravelly calculous matter; the other half was without the bladder in the *Pelvis*, its point reſting upon the *Iſchium*.

A double Pear *by Mr.* Edmund Pitt. Phil. Tranſ. N°. 260. p. 470.

MR. *Pitt* had a double pear, one part growing over, and fixed in the other, not unlike an acorn in its cup; from the edges of the lower pear there grew up five leaves of various magnitude, at almoſt equal diſtances from each other; the largeſt was an inch long, half an inch broad, as large again as the ſmalleſt leaf; theſe leaves grew out of the ſkin of the lower pear, and had no fibres riſing from its carnous part; the largeſt of the leaves had a fibre of the bigneſs of a ſmall hair, continued from the place, where the leaf riſes, juſt within the ſkin

ſkin and looſe from it, to the *Pedunculus*; the outer coat of the *Pedunculus* was continued to the ſkin of the lower pear, and this ſkin to that of the upper pear, the inner fibres of the *Pedunculus* went thro' the lower into the upper pear, and diſperſed themſelves in it; the upper part was twice as big as the lower, and had ſeveral kernels in it, but the lower had none at all.

An Account of Rheumatic Convulſive Pains, *about the* Loins *by Dr.* Chriſtopher Pitt. Phil. Tranſ. N° 260. p. 471. *Tranſlated from the* Latin.

A Perſon about 35 years of age, robuſt, and of a bilious conſtitution, had his pores cloſed up perhaps by a ſudden cold he took after hard working; as ſoon as he was taken ill, he became feveriſh, having firſt a ſhivering cold fit, and next a hot fit, with erratic pains at one time in the ſtomach and inteſtines, and at another time in the breaſt; but theſe ſymptoms were ſoon changed into others; the morbific matter was lodged all in the patients back, having ſuch violent pains from the loins down to the *Coxendix*, that great drops of ſweat run down his hair and face; ſo that he could not lie a-bed, ſit, or ſtand; only that compreſſing his belly againſt the bedſtead, ſeemed to give him ſome relief from the pains in his loins, tho' he could not continue eaſy for any time in that poſture; for being ſeiſed with convulſions, he would raiſe himſelf up with a diſtorted mouth, and a frightful countenance, and then fall back upon the ground (unleſs ſome perſon was at hand to prevent it) where he lay for dead, not being able to move himſelf, and having no more ſtrength to get up than a child; at which time his arms and legs became ſo ſtiff, that they could neither be drawn up, nor ſtretch'd out; his mouth was convulſed in ſuch a manner that a ſpoon could hardly enter it; the convulſions in his back and limbs returned by fits, which were not periodical, but at one time ſooner, at another time later, according to the greater or leſs violence of his pain: This poor patient lay againſt the bedſtead, a poſture he was fond to be in, as above ſhewn; about three weeks, never lying down on the bed, commonly without any ſleep, and in the moſt exquiſite agonies, with frequent convulſions; theſe were the ſymptoms the Dr. obſerved, the patient being otherwiſe in a good ſtate of health; he had no inclination to vomit; his pulſe was ſtrong and equal, his tongue was moiſt, covered with a whitiſh pellicle; the blood taken from him, looked like that

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in pleuretic cases; his urine like that of persons in health: The Dr. did not know what was done to the patient the first week, only that he was once blooded, had a glister and a purge administred to him, together with a large quantity of *Laudanum*, but all to no purpose; at length the Dr. being sent for, as soon as he saw the patient in the misery abovementioned, he ordered to repeat bleeding to a pretty large quantity; next day the Dr. prescribed a gentle purge, and after giving the patient three or four stools he could walk upright, without any pain or convulsions; but the operation was no sooner over, than both these immediately returned and the patient also to his wonted posture against the bedstead; yet the Dr. had some hopes that repeating the purge might effect the cure, seeing the first dose had given some respite; the following day the Dr. gave him resin of jalap and *Mercurius dulcis*, having frequently used this medicine with success in the pain of the loins; but it did not answer here, for the patient had not one stool, tho' the Dr. had added ʒ ij *Syr. è Spin. cervin.* on which account he increased the dose by adding every day alternately ʒ iij and ʒ iiij *Syr. è Spin. cervin.* at length by this means his belly was kept lax, the pain abated, and the convulsions did not return so frequently as before; the Dr. permitted him to drink as much whey as he pleased; and since the purge had wrought on the patient the Dr. could the more freely and the more safely prescribe *Laudanum*, to procure rest to the spirits agitated both by the disorder and the physic; thus at length, by repeating the purge eight or ten times, the pain was quite gone, the convulsions ceased, and the patient was pretty well recovered: In the mean time, to prevent a relapse, the Dr. applied medicines proper in nervous disorders to invigorate the blood and spirits; afterwards the Dr. saw this patient fresh, lively, and able to work; the patient's legs swelled as he recovered, but the tumour was soon discussed by the application of the last mentioned medicine.

The Transmutation of Copper *into* Brass; *by* Thomas Povey, *Esq*; Phil. Trans. N° 260. p. 474.

CAlamine is dug out of certain mines, (of which there are several in the west of *England*, as about *Mendip*, &c.) which lie about 20 foot deep, as coals do; it is burnt or calcined in a kiln or oven made red hot, then ground to powder, and sifted to the fineness of flour, then mixt with ground charcoal, because the calamine is apt to be clammy and clod, and not so apt to incorporate; then they put about seven pounds of calamine into a melting-

melting-pot of about a gallon content, and about five pounds of copper uppermoſt; the calamine muſt be mixt with as many coals, as will fill up the pot; this is let down with tongs into a wind-furnace eight foot deep and remains eleven hours therein; they caſt off not above twice in 24 hours; one furnace holds eight pots; after melting it is caſt into plates or lumps; 45 pounds of raw calamine produce 30 pounds of burnt, or calcined: Braſs ſhruff ſerves inſtead of ſo much copper, but a ſufficient quantity of this cannot always be procured, being a collection of pieces of old braſs, which is uſually got in ſmall parcels: The beſt guns are not made of malleable metal, and cannot be made of pure copper or braſs; for it is neceſſary to put coarſer metal to it, to make it run the cloſer and the ſounder; as lead and pot-metal; bell-metal being copper and tin, and pot-metal copper and lead; about 20 pounds of lead are uſually put to 100 pounds of pot-metal; but about 6 pounds is ſufficient to put to 100 pounds of gun-metal; the calamine-ſtones were formerly fetched from *Poland*, but ſince they are fetched from thence by the *Dutch*.

Beds of Oyſter-ſhells *found near* Reading *in* Berkſhire; *by Dr.* James Brewer. Phil. Tranſ. N° 261. p. 484.

THESE ſhells have the entire figure and matter of oyſter-ſhells; the circumference of the ground where they are dug up contains, as is judged, between 5 and 6 acres; the foundation of theſe ſhells is a hard rocky chalk, above which they lie in a bed of green ſand, upon a level, as near as can be judged; this *Stratum* or layer of green ſand and oyſter-ſhells is near two foot deep; immediately above this layer of green ſand and ſhells, is a bed of a bluiſh ſort of clay, very hard, brittle and rugged, which is called a pinny clay, and is of no uſe; the Dr. found it about a yard deep; and immediately above this, is a *Stratum* of fuller's-earth, which is near two foot and a half deep, often uſed by the clothiers; and above this earth again is a layer of a fine, clear, white ſand, without any mixture of earth, clay, &c. which is near ſeven foot deep; and immediately above this is a ſtiff red clay, which is the uppermoſt *Stratum* whereof tiles are made; the depth of this cannot be conveniently taken, it being ſo high a hill, on the top of which there is dug a little common earth about two foot deep, and immediately under appears the red earth; the Dr. dug with a mattock ſeveral whole oyſters with both their valves or ſhells lying together; in the cavity of ſome of them there is the abovementioned green ſand; theſe ſhells are

ſo

ſo very brittle, that in digging, one of the valves will frequently ſeparate from the other, it being plain they were united together, from the valves correſponding exactly; the Dr. dug up ſeveral that were entire, nay ſome double oyſters, with all their valves united; it is obſervable that there is no ſea near the place where theſe ſhells are found.

An Account of Giants; *by Dr.* Tho. Molyneux. Phil. Tranſ. N° 260. p. 487.

THE *Os Frontis* in the anatomical ſchool at *Leyden*, tho' ſo prodigiouſly large, cannot in the leaſt be ſuſpected to apertain to any other animal than a man, by its being complete every way, and anſwering in all particulars to the common forehead bone of a man, excepting its magnitude; and eſpecially when we conſider that the *Os Frontis* of a man is of ſo peculiar a make, from the globoſe ſhape of the head, that there is not to be found a bone among all the animals of the creation, that bears a reſemblance to its figure, excepting that of a monkey; but all this *Genus* being of a much ſmaller ſize than a man, gives us no umbrage or ſcruple: In order rightly to underſtand and to form a clear conception, both of the agreement in ſhape and the remarkable difference in ſize between this large *Os Frontis*, and the ſame bone in a man of ordinary ſtature; and the better to apprehend what deductions may be made from hence, to determine the true height of the perſon, to whom it formerly belonged; Plate XIII. Fig. 16. ſhews the common ſhape and ſize of the forehead bone of a man of an ordinary ſtature, with its convex or outſide forwards; *abcde* the line the coronal ſuture makes with its indentures, and which ſurrounds the upper edge of the bone, and by which it is joined to both the *Oſſa Bregmatis* or *Verticis*; *e* the place where the coronal and ſagittal ſutures meet; *f*, the part to which the bones of the noſe are faſtened; *gg* the upper part of the orbits of the eyes; *hh* the *Foramina* in the bone over the eyes, that give a paſſage to the two large branches of nerves that ſupply the frontal muſcle, and thoſe of the eye-brows; *ii* the two proceſſes, or protuberances, that join with the firſt bone of the upper jaw, which by ſome accident were broken off the large bone, and therefore are not expreſſed in Fig. 17; the meaſure round the ambit of the coronal ſuture from *a* to *g* was 10 $\frac{1}{10}$ inches; in this bone, from *c*, where the coronal and ſagittal ſutures meet to *f*, where the bones of the noſe are faſtened 4 $\frac{1}{2}$ inches; from *b* drawing a tranſverſe line croſs the forehead to *d* 6 inches; the thickneſs of the bone was about $\frac{1}{4}$ of an inch.

Fig. 18. repreſents the gigantic fore-head bone, expreſſed in the ſame poſture with the former, and drawn exactly to the ſame proportion; *abcde* is the coronal ſuture, in ſome places a little worn and defaced; *c* the place where the coronal and ſagittal ſutures meet; *f* the part where the bones of the noſe were faſtened; *gg* the upper part of the orbits of the eyes; *hh* the two *Foramina* for the nerves that paſs into the muſcles of the eye-brows and frontal muſcle; the meaſure round the ambit of the coronal ſuture from *a* to *c* was about 21 inches; from *c*, where the ſagittal and coronal ſutures meet, to *f*, where the bones of the noſe are faſtened, 9 $\frac{1}{10}$ inches; from *b*, by drawing a tranſverſe line a-croſs the fore-head to *d* 12 $\frac{2}{10}$ inches; the thickneſs of the bone, from one table to the other, about $\frac{1}{2}$ an inch.

Fig. 19. ſhews the inſide of the ſame gigantic bone, drawn likewiſe in the ſame proportion; *kk* the thickneſs of the bone; *l* the ſharp and high proceſs of the *Os Cribroſum*, called *Criſta Galli*.

By comparing theſe figures it is evident what an exact conformity there is in every particular between this large bone, and the like bone in a man of an ordinary height, and that they differ no ways but in magnitude; and as to the difference of ſize, the dimenſions of the larger were more than double thoſe of the ſmaller; whence it follows, that this large *Os Frontis* was above twice as big every way as a common bone of that ſort in a full grown man; and arguing from the proportion that the ſame bone in other men bears to their height, it muſt follow, that the man to whom this *Os Frontis* belonged was more than twice the height that men uſually are of, according to the common courſe of nature; and ſetting down, as the moſt moderate computation, but 5 $\frac{1}{2}$ feet for the height of a man, he to whom this bone belonged, muſt have been more than 11 or 12 foot high: It cannot reaſonably be ſuppoſed, that a man of an ordinary ſize and ſtature could have had ſuch an exceeding large head; for the Dr. conceives he could not poſſibly ſubſiſt, whilſt ſo ponderous and exceſſive a maſs of bone as this ſcull, with all that quantity of brain requiſite to fill its ſpacious cavity, was growing; much leſs continue ſo long alive, as to come to maturity of years, to which it is certain this perſon muſt have arrived, by the great thickneſs and ſolidity of this bone, as well as its large ſize; and tho' it is true, that ſometimes from obſtructions, or other morbific cauſes, our glands and ſofter *Viſcera* are ſo unequally nouriſhed, as to grow to an immenſe ſize; yet ſuch a preternatural exceſs of growth in a hard and bony part, the Dr. does not think, has ever yet been obſerved; and

and if it ſhould be alledged that infants far gone in the rickets are frequently obſerved to have great heads in proportion to their emaciated ſmall bodies; and that young children are alſo liable to another malady called *Hydrocephalus* or dropſy in the head, which ſometimes ſo dilates it, as to ſwell the ſcull to a yet more immenſe ſize; but neither of theſe diſorders, otherwiſe affect the head, than by a preternatural collection of ſerous humours incloſed in the brain, which extend the yielding ſides of the weak and tender ſcull, but do not in the leaſt increaſe its bony ſubſtance; nay, on the contrary, rather diminiſh it; being as is always obſerved, reduced to a more than uſual thinneſs, being ſometimes, no thicker than an egg-ſhell, or piece of parchment; nor can ſuch diſtempers poſſibly affect adults, ſo as to enlarge their ſculls; becauſe, all the bones are by that time become ſolid, and firmly knit together, ſo as to be no way capable of further growth or extenſion; and hence it is, that theſe maladies are incident to children, whilſt their ſculls are ſoft, pliable, and truly membranous, rather than bony; and daily experience aſſures us, that unleſs ſuch diſeaſes be timely removed by the phyſician or ſurgeon's art, or overcome ſo early by the ſtrength of nature, as that the children have time enough to outgrow this diſproportion in their heads, by the bulk of their body coming up to it, before it ariſes to too exorbitant a degree of magnitude, they all die in their infancy, and theſe ſculls are eaſily diſtinguiſhed from all others, by the large *Fontanel*, or opening in the mole of the head, that remains membranous, and never becomes like the reſt of the ſcull, a bony ſubſtance; and that they cannot poſſibly arrive at manhood is plain; for this monſtrous and unequal ſwelling of their heads, meeting with no reſtraint, but ſtill increaſing, when it comes to ſuch a certain degree, that its extravagant dimenſions become inconſiſtent with the natural functions of the body, the animal oeconomy muſt ſink under the preſſure of ſuch a load, and the whole machine tend to its diſſolution; as not being able to bear any longer with ſo highly morbid a diſpoſition, in ſo principal, and ſo extremely neceſſary a part to life as the brain, the fountain of all ſpirit, ſenſe and motion: The Dr. does not deny, but that by one accident or other, ſome diſproportion ſometimes happens, between the head and the reſt of the body, in ſuch as are grown up to the compleat ſtature of man; yet a diſproportion of this kind, however conſpicuous to the eye, and unſeemly, is never ſo extraordinary as to be conſiderable in itſelf; for the circumference of a man's head of the common ſize, is uſually about 22 inches, and if we chance to ſee one

of 25 or 26, and ſhould there be found a head ſtill larger, 28 or 29 inches in ambit (which for the reaſons abovementioned, has ſcarce or ever happened, unleſs where the proportion of the other parts of the body were ſuch as neceſſarily required it) ſuch a one would be really wonderful, and counted monſtrous; yet the circumference of the head, of which this large forehead bone was a part, ſo far exceeded the largeſt of theſe meaſures, that, as the Dr. computed its dimenſions, when it was entire and covered with the hairy ſcalp, it was about 44 inches round; and therefore muſt have had a body belonging to it, that bore a proper proportion to this ſpacious circumference: Nor does the Dr. apprehend ſo great a ſtature as this in a human body, tho' indeed it be extraordinary, any way abſurd or repugnant to the courſe of nature; but rather, if duly weighed, very conformable to a certain anamolous method ſhe apparently effects ſometimes in her productions: Thus we cannot but obſerve in the vegetable kingdom, that ſome are of the dwarf-kind, whilſt others ariſe to ſo ſtupendious a growth, that they more than double the bulk even of ſuch as are eſteemed large in the ſame tribe; and amongſt animals, if we compare that ſmall low breed of race-horſes from the *Iſle of Man*, uſually called *Mank*'s horſes, to that large breed they have in *Northamptonſhire* in *England*, or in the biſhoprick of *Liege* in *Flanders*, we may properly enough eſteem theſe a ſort of gigantic horſes; and the ſame thing may be ſaid of the *Iriſh* wolf-dog, of the grey-hound kind, which is of a beautiful and large make, far ſurpaſſing the common grey-hounds.

That nature takes the ſame uncertain meaſures in the generation of mankind, the Dr. thinks, is not leſs apparent; thus the *Laplanders* are remarkable for their low ſtature; and it is certain, there are, and have been dwarfs in all ages and countries, and ſome of them of a very extraordinary ſmall ſize of body, not above 30 inches in height, and ſome not ſo high; now ſince natural cauſes operate ſo as to produce human creatures, partaking of all properties common to the ſpecies, and of ſo ſmall a model, as to fall ſhort even of half the common ſtandard, the Dr. cannot think it unreaſonable to imagine that the ſame natural cauſes may ſometimes act in the other extreme likewiſe.

There is a manifeſt alliance and congruity obſervable in nature, between the ſtature of man's body, and his age during the time of his growth; and as $5\frac{1}{2}$ feet may well be eſteemed the moſt ſettled and ordinary degree of height in a man; ſo about 70 years may juſtly be allowed the moſt common period of his age; yet daily experience and obſervation acquaint us with thoſe that

vaſtly

vaſtly exceed theſe limits, in both theſe reſpects, as in the inſtances of *Tho. Parr* and *Henry Jenkins* both of *England*, and the Counteſs of *Deſmond* and Mrs. *Eccleſton* both of *Ireland*, who fully compleated double the uſual term of life; ſo we have no reaſon to queſtion the accounts given of others, that have been found in ſtature double the common ſtandard of man; nay, both theſe properties, longævity, and high ſtature, do ſo naturally reſult each from their proper cauſes, that they are often obſerved to become hereditary, and run in whole families; whence the *Greeks* had their *Macrobii*, and the *Romans* their *Celſi*; and in *Paleſtine* of old they had their *Anakims*, or ſons of the giants; ſo that human gigantic bodies are no way inconſiſtent with the courſe of nature; and indeed, we have ſome clear teſtimonies given us by authors of unqueſtionable credit and veracity, that there actually have been men in the world, and it is likely there ſtill are, of ſo large a bulk, and ſo high a ſtature of body, as properly to deſerve the name of giants: *Edmund Mallone*, when he ſtood with his ſhoes off, meaſured full 7 foot 7 inches in height; *Walter Parſons*, porter to King *James* I. was much of the ſame ſtature: *Isbrand Diemerbroeck* tells us, he ſaw at *Utrecht* a man 8 ½ foot high, born at *Schoonhoven* in *Holland*, of parents of an ordinary ſtature; *Jo. Goropius Becanus* ſaw a youth almoſt 9 foot high, a man near 10 foot, and a woman that was quite 10 foot in height; *Pliny* the naturaliſt ſpeaks of ſeveral men in his age much of the ſame height, or ſomething taller; and it is not improbable, that where both the ſoil and climate concur, and are naturally diſpoſed to produce plants, fruits and ſeveral kinds of animals, of a much larger bulk than any our country affords; ſuch as the oſtriches and cunters among birds; the largeſt crocodiles, the mouſe deer, the elephant, the rhinoceros, the hippopotamus, *&c.* among quadrupeds; in thoſe parts of the world, where ſuch vaſt animals are met with, it is not unlikely that men may ſometimes be found of a much greater ſize than any here among us: *Andreas Thevet*, in his deſcription of *America*, tells us, he was ſhewn by a *Spaniſh* merchant, the ſkull and bones of an *American* giant, 11 foot and 5 inches high; the bones of the legs meaſured full 3 foot 4 inches in length, and the ſkull was 3 foot 1 inch about; which circumference the Dr. obſerves, is exactly proportionable to the length of the legs, and if we make an allowance for the hair and ſkin that covered the ſkull when he was alive, it falls very little ſhort of the dimenſions of the giant's head before ſet down.

From

From these warrantable histories, and this particular bone before us, we may clearly deduce, that there have been in nature human bodies 11 or 12 foot high, which surpasses the stature of the tallest giants mentioned in holy writ; for the height of *Goliah* of *Gath*, is expresly said I. *Sam.* xvii. 4. to be but 6 cubits and a span; and taking a cubit in the most usual acceptation, for a foot and a half, his stature will not amount to above 9 foot 9 inches: Indeed we may reasonably conclude, that *Og* the king of *Bashan* must have considerably exceeded *Goliah* in height, if we make an estimate of his stature by the dimensions of his bedstead, which is said to have been kept as a memorial of him at *Rabbath* of the children of *Ammon*, and to have been 9 cubits in length, *Deut.* iii. 2: But then we cannot imagine, but that his bed must of necessity have been much longer than his body; and the least allowance we can make for the overplus, is the space of 9 inches above his head, and as much below his feet, by which distinction, it will follow he was not above 12 foot high; much of the same standard with this giant before us.

Worms in Sheep's Livers, Gnats and Animalcula in the Excrements of Frogs; by M. Anthony van Leewenhoek. Phil. Transf. N° 261. p. 509.

WHEN sheep have drank water, wherein these animalcules were, they are carried with their food out of the stomach into the beginning of the guts, where the gall-bladder empties itself, and being pleased with the taste of gall, they swim against it into the bladder itself, and from thence go into the vessels, (like veins and arteries) of the gall; for M. *Leewenhoek* having searched the liver of a sheep, in the vessels whereof were several animalcules and open'd a nodous part, he took out one of them, which was twice as long in the vein and indifferently small; to discover, if possible, the said *Animalcula* in the water, M. *Leewenhoek* went in the latter end of *August* into several pasture grounds, where sheep fed that were troubled with these diseases, and there out of the low ditches he took up some water in a clear glass, which he examined with a more than ordinary magnifying glass, and observed several sorts of animalcules swimming therein; the greatest sort were those that produce gnats, which have stings, wherewith they annoy both man and beast; one sort of the animalcules generally sunk to the bottom, as soon as they ceased to move their bodies, and when in moving they came to touch the surface of the water with any prominent part, then their heads hung down and they remained thus upon the surface; the second sort

ſort of theſe animalcules could not remain at the bottom, but were generally carried towards the ſurface of the water, and there they continued hanging by two horns that came out of the upper part of their bodies; and when they would ſink, they had a ſtrong and vehement motion, by means of a tranſparent inſtrument fixed on the end of the tail; the two ſorts of gnats proceeding from time to time from theſe animals had ſtings; they placed themſelves upon the glaſs, and ſometimes alſo ſat down upon the water, ſpreading out their long legs thereon; M. *Leewenhoek* obſerved ſeveral round particles of the bigneſs of a large grain of ſand drive and move in the water; and when he brought theſe particles before the magnifying-glaſs, they not only appeared round, but had the outward ſkin ſet over with ſeveral protuberant parts, which ſeemed to him to be triangular and pointed towards the extremity; ſo that on the great circle of one of theſe round bodies ſtood ſuch convex or protuberant particles, orderly and equally ſet from each other to the number of 2000, which never lay ſtill, and their motion proceeded from their turning round; the ſmaller the particles were, the greener was their colour, and *é contrá* in the particles as big as a grain of ſand, there was no green colour at all diſcernible on the outſide; each of theſe particles included 5, 6, 7, nay ſome 12 ſmall globules, of the ſame ſhape with the body wherein they were included: Among the reſt M. *Leewenhoek* perceived that the outward part of one of the largeſt particles began to open, out of which, one of the included globules of a delicate green colour, ſlipped out, and began to move in the water, as that part had done, out of which it proceeded; after this, the firſt round particle remained without any motion at all; and ſoon after, the ſecond and third particles ſlipt out one after another, 'till they all by degrees came out; after the ſpace of ſome days the firſt round particle united again with the water, for M. *Leewenhoek* perceived no ſigns of it; and in all the motions of the firſt round particle, he could not obſerve that the included particles changed their place, nor touch'd one another, but remained equally diſtant: As there was a great many of the ſaid round particles in one glaſs, wherein were alſo ſeveral living creatures, he obſerved that in three days time they all diſappeared, ſo that he could not diſcern any of the ſaid particles in the glaſs: M. *Leewenhoek* had a glaſs-tube of about 8 inches long, as Plate XIII. Fig. 20. of the thickneſs of a gooſe-quill, wherein he put ſome drops of water, as C D; he left one end at A open, and the other end B he ſtopped with a piece of cork, ſo that between D and B was nothing but air, which being ſhut up in the tube

tube cannot remain of the ſame magnitude or expanſion but changes every moment; for you cannot ſo much as touch the tube with your hand, breath, or any part of the body that is a little warmer than the air, wherein the tube is, but the air in the tube is alſo expanded, ſo as to put the water into motion, which is forced from D to A, altho' we perceive no motion with the naked eye; now, as the leaſt warmth expands the air included in the leſſer tube, ſo the warmth is alſo ſoon over, and the water receives another motion from C to B; in this water there were two of the ſaid ſmall globules, of the largeſt ſort, in each of which were included five ſmaller globules, pretty well grown in bigneſs; and in a third large particle lay ſeven leſſer round ones which were incomparably ſmall; four days after, the ſaid particles had been put into the tube M. *Leewenhoek* ſaw that the outer pellicle of two of them, which was exceeding thin and tranſparent, was broke in pieces; and that the ten particles included in the two great ones were, by the motion of the water, moved from one ſide to the other; he further obſerved, that, after the expiration of five days, the ſmall particles included in the third great particle, were not only increaſed in bigneſs, but he could alſo diſcern that from the inſide of the ſmall particles proceeded other round ones; after the expiration of five days more, the third round particle was alſo a little broke open, and the particles that lay therein were alſo got out; and altho' it was open on one ſide, yet it turned round in the water, as nimbly as ever it had done before; ſome days after, M. *Leewenhoek* could not diſcern any but ſmall particles, whereof the great one conſiſted, which alſo vaniſhed in a little time; he never miſſed a day, but he looked upon the ſmall particles that came out of the greater one, and obſerved that they not only increaſed in bigneſs, but that the incloſed particles alſo grew bigger: In the latter end of *September*, M. *Leewenhoek* perceived that the included particles were not ſo exactly round, as the great ones that incloſed them; and alſo that ſome of them were protuberant, and that the laſt particles that came out of the great ones, not being round, lay againſt the ſide of the glaſs without any motion; now the laſt greater particles, when they were diſcharged of their incloſed ones, or broken in pieces, were about four times leſs than thoſe that came out of them; wherefore he concluded that either they had not their full growth, or not their full food; he alſo obſerved, that the ſaid round particles were of an equal weight with the water, ſo that by the leaſt motion the water received from the air, they were alſo put into motion: In Fig. 21. E F repreſents one

of

of the larger particles, with its incloſed particles, (that were increaſed ſo much in bigneſs, that they were ready to be emitted) which lay more regularly here, than in any of the reſt, where there was not the ordinary motion, which made M. *Leewenhoek* believe that this was occaſioned by the incloſed particles not lying all equally diſtant from their center, and that thoſe that lay fartheſt from the center made one ſide of the incloſing round particle heavier, which hindered the motion.

When M. *Leewenhoek* perceived that the great number of round particles in the great glaſs mixed with a great number of *Animalcules*, were gone in three days time, he conſidered whether theſe particles were not created as food for the *Animalcules*: Now when we ſee, that the abovementioned globules did not proceed from themſelves, but by procreation, as we know that all plants and ſeeds are procreated, each ſeed, tho' never ſo ſmall, having its plant incloſed within it; we are now more than ever aſſured of the procreation of all things; M. *Leewenhoek* lays it down as a certain truth, that the ſmall round particles found in the great ones are ſeeds, and that without them the round particles could not be produced.

M. *Leewenhoek* caught a little frog, which he judged had been an egg the preceeding ſpring, and putting it into a glaſs-tube an inch wide and ten inches long, he ſtopped both the ends up with cork, yet after ſuch a manner, as that the air had free admiſſion at one end; he viewed the toes of the fore-legs with a magnifying-glaſs to obſerve the circulation of the blood, which he could diſcern with great difficulty; but when he came to look upon the hindmoſt legs, he ſaw ſeveral days ſucceſſively upon the ſkins between the toes, made on purpoſe to ſwim withal, as in all water-fowls, the blood circulate in ſeveral very ſmall veſſels; he alſo obſerved, that when the frog ſtretched out its leg, the circulation was thereby ſtopt for a little time, but when it had ſtood ſtill, the blood began to circulate again; the reaſon of which he imagined was, that when the animal thruſt its legs againſt the glaſs to climb up, that then the blood-veſſels were thereby compreſſed, and the circulation hindered; after the frog had been 24 hours in this tube, M. *Leewenhoek* obſerved its excrements as it were in a heap; after it had been 48 hours there, it fouled again, and looking thro' a magnifying-glaſs he obſerved in the firſt excrement, that it had fed upon an animal, whoſe body was beſet with hairs of various thickneſs, very ſharp pointed, which he judged to be ſome flying inſect; when he viewed the ſecond excrement, he obſerved no hairs at firſt; but

upon laying it asunder he saw not only some hair, but also a piece of the foot, part of the eye and of the wing, besides several pieces of the skin of an animal, which he judged to be a small insect, whose wings are covered with a sheath, very like those called beetles; these excrements lay in a clear moisture round them, wherein swam or creeped some eels, or about 30 small worms; the fore and hinder-parts of whose bodies were very clear; these eels in the frog's excrements are very like those found in vinegar, if not altogether the same; only with this difference, that the eels in vinegar, as they are taken out of the mother's *Uterus*, are somewhat thinner and harder; in the first excrement M. *Leewenhoek* discovered only two of these eels; when he looked next day, and saw that the moisture wherein the eels swam, was partly evaporated, and that the eels moved but very little, he put some rain water about the excrements where all the worms and eels were, and that water he put into a small glass-tube, wherein were six eels, thinking to keep them alive, and observe whether they would breed any young ones; yet he found the contrary, for they moved less, and within a few hours after, some were quite motionless; and next day he saw, after strict examination, only a part of an eel; from which he concluded that the eels were dissolved in the water: The frog had, by its motions in the glass-tube, so separated the first excrement, that M. *Leewenhoek* saw almost the whole wing of a flying insect, about the bigness of a gnat, and this was almost quite entire, so that he could see perfectly the great number of small hairs, which grew all over the outside, and also upon the edge of the wing; underneath this wing he saw three of the said eels, and another in another place, that had still a strong motion; on the fourth day after the excrements were made, he saw some eels which were alive, both above and under the wing; and because the moisture wherein they lay was but very small, so their motion was but little, and afterwards he could perceive no motion at all: From these observations M. *Leewenhoek* concludes that water was not proper for these eels, and that they either came out of the ground, or that the animals the frog fed upon, were loaded with them; on the fifth day the frog had fouled again, and it lay oblong against the glass, without any moisture at all; he took it out of the glass and spreading it abroad, because it appeared blacker to the eye than the former, and therein he also saw parts of flying insects; and in this there also lay several of the abovementioned eels,

but

but they were all dead, and somewhat less than the former, further he put the frog into a glass with water, out of which it made its escape and got away.

The Way of making several China-varnishes; *by Dr.* William Sherard. Phil. Trans. N° 262, p. 525.

TAKE of crude varnish 60 ounces, ordinary water 60 ounces, mix them well together, till the water disappears; afterwards put this matter into a wooden vessel, 5 or 6 palms long, and 2 or 3 broad; mix them with a wooden *Spatula* for a whole day in a summer's sun, and for two in the winter; it is afterwards put up in earthen vessels with a bladder over it; and this is the varnish prepared in the sun.

The way of boiling the oil of wood, called by the *Portugueze Azeite de Pao*: Take 20 ounces of oil of wood, 20 drachms of that of the fruit; give them 5 or 6 boils, till they become a little yellow; let them cool, and put thereto 5 drachms of powdered quick lime.

To give the first grounds called *Camiscia:* Take swines-blood and quick-lime powdered, mix them well; lay this mixture on the wood, and when it is dry, smooth it with a pumice-stone.

To make the black varnish: Take of the varnish prepared in the sun 60 ounces, stone black allum (supposed to be a sort of copperas) dissolved in a little water 3 drachms, 70 drachms of lamp-oil, called by the *Portugueze Azeite de Candea*; it is prepared in a wooden vessel, as the varnish prepared in the sun, observing to put in the lamp-oil at two several times.

To make the varnish of the colour of pitch: Take of the oil of wood crude, called *de Pao*, 40 drachms; of the lamp-oil, called *de Candea*, crude, 40 drachms; it is prepared in the sun in a wooden vessel, as prepared varnish.

To make red varnish: Take 10 drachms of cinnabar, 20 drachms of varnish prepared, a little of the oil *de Candea*, or lamp oil, mix them well together.

To make yellow varnish: Take of the yellow colour 10 drachms, 30 drachms of prepared varnish, with some lamp-oil.

To make varnish of a musk-colour: Take of the red varnish 10 drachms, of the black varnish 4 drachms; mix them well.

To find the exact Quantity of Volatile Acid Salts *contained in* Acid Spirits *by Mr.* Homberg. Phil. Tranſ. N°. 262 p. 530.

M. *Homberg*, chemiſt to the Royal, Academy in a diſcourſe of his obſerved, that tho' we have a very ſure way of meaſuring the quantity of ſolids by balances and ordinary weights, yet we cannot come to the ſame preciſion in liquors; and much leſs can we know the preciſe quantity of the different ingredients in thoſe liquors, as what is the quantity of acid volatile ſalt contained in acid ſpirits; and for that purpoſe he contrived a new aræometer, or a meaſure of liquors, of which the deſcription follows,

A Fig. 22. Plate XIII. is a glaſs-bottle like a ſmall matraſs, whoſe neck B C is ſo ſmall, that a drop of water therein takes up the ſpace of five or ſix lines; near that neck is a ſmall capillary tube D about ſix lines long, and parallel to the neck B C; in the opening, B is a little dilated in faſhion of a funnel, for pouring the liquors the more eaſily into the bottle, and the ſmall tube D is in order to give egreſs to the air contained in that veſſel when the liquor is poured in at B; the point C is a little mark at the ſame height with the extremity of the ſmall tube D; when the veſſel is filled with ſome liquor for the experiments, it is poured in by the opening B, untill it comes out by the ſmall tube D, and if the height of the liquor is even with the mark C, it is well; if lower, you muſt fill more to that point; and if the liquor is higher, you muſt ſtrike ſoftly upon the opening B, till the overplus be even with the point C in the neck of the bottle; by that means we have always exactly the ſame volume of liquor, and we may know how much the ſame volume of the ſeveral liquors preciſely weighs, the one more than the other; but as the volume of liquors is not always the ſame, and changes according to the alteration of the weather, we muſt conſider this variation in the experiments made at ſeveral times, when we compare the weight of a liquor weighed in the ſummer time, with the weight of another weighed in winter; for the ſame liquor being more rarefied in a hot, and more condenſed in a cold ſeaſon, the ſame volume of it will be more weighty in cold than in warm weather; for this purpoſe M. *Homberg* has given a table of the various weights of the moſt uſual liquors in the coldeſt and hotteſt ſeaſon, as follows.

The

	℥	3	gr.			℥	3	gr.
The araeometer full of mercury in the ſummer time	11	0	6	in winter		11	0	32
Full of oil of tartar — —	1	3	8	— —		1	3	31
Spirit of urine — — —	1	0	32	— —		1	0	43
Oil of vitriol — — —	1	3	58	— —		2	6	3
Spirit of nitre — — —	1	1	40	— —		1	1	70
Aqua fortis — — — —	1	1	38	— —		1	1	55
Vinegar — — — —	0	7	55	— —		0	7	60
Spirit of wine — — —	0	6	47	— —		0	6	61
River-water — — — —	0	7	53	— —		0	7	57
Diſtilled water — — —	0	7	50	— —		0	7	54

This empty araeometer, weighs one drachm, and twenty eight grains.

By this table it appears that all liquors, and even mercury itſelf, are condenſed and rarified in cold and hot weather.

M. *Homberg* ſays, that acid ſpirits are no other than a ſalt diſſolved by a little water, its taſte as well as its effects ſhewing it to be an acid; he calls it volatile, becauſe it is raiſed by the fire with the phlegm, and can hardly be ſeparated from it and reduced into a dry form; he has ſhewn the way to know the quantity of ſalt contained in a determined quantity of acid ſpirit; *viz.* by comparing the weight of its volume, with the weight of another ſpirit, of which the quantity of ſalt contained therein was known; firſt, he poured upon an ounce of ſalt of tartar well dried, as much acid ſpirit (the volatile ſalt therein contained being known) as the ſalt of tartar could take up; then he evaporated all the inſipid phlegm out of this, and he weighed the matter; the quantity of its weight, above that of the ſalt of tartar before ſaturation, is the quantity of volatile acid ſalt, which has been taken up by the ounce of the ſalt of tartar; here is the table of the quantity of acid neceſſary to the perfect impregnation of the ſalt of tartar; and by the ſame means the table of the quantity of acid volatile ſalt, contained in an ounce of ſeveral acid ſpirits; for the perfect impregnation of one ounce of ſalt of tartar, there was poured upon it one ounce, two drachms, 36 grains of the ſpirit of nitre; the weight of that ſalt after the evaporation of the inſipid phlegm was encreaſed to 3 drachms 10 grains above an ounce; that increaſe from the acid remaining in the ſalt of tartar, ſhews that an ounce of ſpirit of nitre contains two drachms

drachms 18 grains of acid ſalt; ſo for the impregnation of an ounce of ſalt of tartar, there was poured upon it two ounces five drachms of ſpirit of ſalt; and the increaſe after the evaporation has been found three drachms 14 grains; and therefore an ounce of ſpirit of ſalt contains one drachm 15 grains of acid ſalt: Upon an ounce of ſalt of tartar was poured five drachms of the oil of vitriol; the increaſe was found three drachms five grains; therefore an ounce of oil of vitriol contains three drachms 65 grains of acid ſalt: Upon an ounce of ſalt of tartar was poured of *Aqua fortis* an ounce two drachms 30 grains; the increaſe was found three drachms ſix grains; therefore an ounce of *Aqua fortis* contains two drachms 26 grains of acid ſalt: Upon an ounce of ſalt of tartar was poured diſtilled vinegar 14 drachms, the increaſe was found three drachms, 36 grains, therefore an ounce of diſtilled vinegar contains 18 grains of acid ſalt: It appears by this table, that the quantity of acid ſalt for ſaturating the ſalt of tartar is nearly the ſame, tho' the quantity of acid liquors ſhould be very different; it is only the acid of vinegar, whereof the ſalt of tartar retains more than it does of the others, which M. *Homberg* attributes to the ſubtilty of the particles of the vegetable acid, that have been very much divided by the alterations in the fermentation of the liquors of the plants, &c. of the wine, and alſo in the diſtillation, which alterations the mineral acid has not received; that the vegetable acid by its ſubtilty of particles can impregnate a greater quantity of liquor, than the ſame quantity of mineral acid, and ſo is more eaſily ſublimed by the fire than the others.

By theſe obſervations M. *Homberg* makes the reaſon of ſome caſes evident, which would otherwiſe be difficult to be explained without them; as it is well known that one ounce of *Aqua Regia* compounded with the ſpirit of nitre and armoniac-ſalt diſſolves twice more gold, than an ounce of the ſpirit of ſalt can do; chemiſts aſcribe that effect to the ſoftneſs of the points of one acid, and to the hardneſs of thoſe of the other; when theſe obſervations ſhew evidently that the ſpirit of nitre contains twice more acid ſalt, than the little volume of ſpirit of ſalt, and point out at the ſame time the true cauſe of this effect: M. *Homberg* alſo ſhew'd how that by comparing theſe two tables we may know the quantity of acid ſalt contained in any acid ſpirit, in the following manner; he took an acid ſpirit, as ſpirit of nitre, which he weighed by his aræometer, and at the ſame time he weighed alſo diſtilled water (for the weight

of

of the phlegm contained in the acid ſpirit, is as the weight of the diſtilled water) then he conſulted the tables, where he ſaw that the bulk of ſpirit of nitre compared with the like bulk of diſtilled water, has given a certain quantity of acid ſalt for each ounce; and from thence he concludes, that the bulk of other ſpirit of nitre whoſe weight is known, compared with the like bulk of water, will give a determined quantity of acid ſalt, which will be obtained by the computation of the ratio of the weight of thoſe ſpirits with the weight of the like bulk of diſtilled water, by concluding from them and from the known product of acid ſalt for the unknown product of the ſame.

An unuſal Parhelion *and* Halo *by Mr.* Gray. Phil. Tranſ. N° 262. p. 535.

APRIL 7. 1699. between 4 and 5 o'clock Mr. *Gray* obſerved on each ſide the ſun A Plate XIII. Fig. 23. a *Parhelion* B C connected by an *Halo* B D C of the uſual diameter; they had each of them a tail of a whitiſh colour, extended oppoſite to the ſun, of about 15 or 20 degrees in length; the upper part of the *Halo* was touched at D by the arch of a circle, whoſe ends were turned towards the *Zenith* Z; it had the colours of the iris but faintly; betwixt this and the *Zenith* was another portion of a circle E, which had the colours of the iris more lively than the former.

A Journal *kept from* Scotland *to* Darien *in* New Caledonia, *with an Account of that Country; by Dr.* Wallace. Phil. Tranſ. N°. 262. p. 536.

SEPT. 2. 1699, we weighed at *Madera* and were under the *Tropic* of *Cancer* by the 10th, when the uſual ceremony of ducking from the yard's arm was performed on ſuch as could not pay their *Tropic* bottle; all this time we had a briſk and conſtant trade-wind, which laſted three days more; but afterwards we had it more variable than is uſual in that part of the ſea: The 28th we made *Deſeada*, a ſmall high iſland, about a league in length, and as much in breadth; it is full of trees, but whether it affords water or not we know not; it is uninhabited; next morning we were betwixt the iſlands of *Antegoa* and *Montſerat* belonging to the *Engliſh*, both pretty large and mountainous; *Antegoa* is peopled with *Engliſh* for the moſt part, and *Montſerat* with a mixture of *Engliſh* and *Iriſh*; their product is ſugar and tobacco; we were in the afternoon cloſe by *Redonda*, a ſmall rock about a mile long, inhabited

bited only by noddies and boobies; when we were some leagues from *Redonda*, we saw at the same time *Antegoa*, *Montserat*, *Redonda*, *Nevis*, St. *Cristopher*'s and *Statia*; we sailed close by *Nevis*, it bearing north of us; it is a small well-peopled island; its product is sugar; St. *Christopher*'s is a large island, thinly peopled, half of it belonging to the *English*, and half to the *French*; night parted us from these islands, and next day, which was the 30th, we came within sight of *Santa Cruz*, belonging to the *Spaniards*; when we were within four leagues of it, there was held a council; upon which the *Unicorn* and *Snow*, were sent to St. *Thomas*, a small island belonging to the *Danes*; it is a free port, and they say it is well fortified; we went on to the southward of that island; and next day being the 1st of *October*, we past the S. W. corner about 12 o'clock; it is very level towards the south; that night and next day we saw *Crab Island*. *October* 2. we came to it, and sent some of our people ashore, and took possession of it in the Company's name; *October* 4. we stood to the leeward, hearing there was a harbour there; when we came we saw the *Danish* colours on the shore, for the governor of St. *Thomas* had sent 14 men and a captain to take possession of it in the king of *Denmark*'s name; but we found that we had taken possession of the place before they came from St. *Thomas*; they entered their protest; yet seemed to be glad enough of our neighbourhood; we notwithstanding had our flag upon the shore all the time we stayed with 100 men and captain *Maclean* governor; on the 8th we left this place, and on the 17th we made *Nostra Signiora della Popa*, we lay aside there along the coast, until the 3d of *November*, generally losing by night, what we had gained by day; *Crab Island* is about 6 leagues long, and in some places 5 broad, the soil is very good; it abounds in woods; the south side is full of bays, very fit for anchoring in, but the best of all is that to the leeward, where the *Danes* hoisted their colours; it would have been worth our while to possess it; but it has this inconveniency, that nothing but strength of men or peace with our neighbours, could render it secure; it is called *Crab Island*, from the number of land-crabs therein: *November* 3d, we anchored before *Golden Island* and sent in our pinnace to the bay; the natives had hoisted a white flag as a token of peace, and told us a great deal of captain *Swan*, captain *Davis* and others, taking us for *English*, by reason of our red flag; at last they asked us our business, and we told them we designed to settle amongst them, and be their friends; they told us we were very welcome; when we had conversed

for

for ſome time with them, and viewed the harbour we came aboard: The 4th we came into the great harbour of *Caledonia*, which is a very good one, being about a league in length from N. W. to S. E. about half a mile broad at the mouth; and further on, a mile or more in ſome places; it is large enough to contain 500 ſail of ſhips; the greateſt part of it is land-locked, ſo that it is ſafe from any wind that blows; the harbour and the ſea make the land lying between them a *Peninſula*; there is a point of the *Peninſula* at the mouth of the harbour, that might be fortified againſt a whole fleet; it ſecures the harbour, ſo that no ſhip can enter but what will be within reach of its guns; it alſo defends half the *Peninſula*; no guns from the other ſide of the harbour can hurt it, nor dare any ſhip carrying guns enter for the breaſt-work at the point; the other ſide of the *Peninſula* is either a precipice, or defended againſt ſhips by ſhoals and breaches, ſo that there is only the narrow neck which is not fortified by nature; yet it may be fortified by art, and made impregnable; and there is land enough within it, if it were all cultivated, that might yield 1000 hogſheads of ſugar every year; the ſoil is rich, the air good and temperate, the water ſweet, and every thing contributes to make it both healthful and convenient; in the harbour and creeks hereabouts, are turtles, manatees, and a vaſt variety of very good ſmall fiſh, from the bigneſs of a ſalmon to that of a perch; the land affords monkeys of different ſorts, as alſo wild deer, *Indian* rabbits, wild hogs, parrots of ſeveral kinds, paroqueets, macaws, pelicans and a hundred more we have no name for; beſides, there are land-crabs, ſouldiers, land-turtles, lizzards, guanha's, cock-lizzards, and ſcorpions, partridges, pheaſants and a ſort of turkey; all the birds in this country are beautiful, but none that we could obſerve had any notes; we have a monkey on board that chirps like a lark, but will never be bigger than a rat; this place affords vaſt numbers of monſtrous plants, ſome of their leaves exceeding three ells in length, and at the ſame time very broad; beſides theſe, which are reducible to no tribe, there are a great many of the *European* ſpecies (but ſtill have ſomething odd about them) as *Lingua cervina* of different ſorts, *Filix* or fern of different kinds, *Polypodium*, ſeveral of the *Plantæ papilionaceæ*, *muſci*, *fungi*, *convolvuli*, and a great many more.

The people are generally very civil and ſagacious, have all of them good features, are of a low ſtature, but very well built; they are of a copper-colour and have black hair; they uſed to go naked, but are now as well cloathed as we are, they wear a plate of

gold in their nose, and several rows of beads about their necks and wrists; they cover their *Pudenda* with a piece of bark or sometimes silver; they seem to be very ill provided, not having a *Penis* half an inch long, yet no doubt it is longer, for perhaps they may sheath it up as dog's and horses do: The women are generally the most pitiful creatures a man ever saw; their habit differs from the men's; they ordinarily wear a ring in their nose; they have petticoats, and wear a veil over their face: This people is under no formal government; every captain commands his own river, bay, or island where he lives; the most considerable of which is one Captain *Ambrosio*, he commands the country particularly about the *Samballo*'s *Point*, and when he pleases, he can levy all the men about 20 leagues, betwixt that and the gulf; there is another Captain *Pedro*, that lives in the same house with *Ambrosio*, and is his nephew and son-in-law; one Captain *Andreas* commands the river *Das Armas*; another Captain *Brandy* commands about the *Golden Island*; a 5th Captain *Andreas* commands the country adjoining to our settlement, and a 6th Captain *Pedro* is his collegue; one Captain *Pacigo* commands at *Carret Bay*, and Captain *Diego* commands the gulph: *Diego* seems to be the next considerable to *Ambrosio*, who are both old men; they are all very much our friends, and fond of us; some of these captains wear the *Scottish* flag in their canoes; there is no such thing as a king or emperor of *Darien*, nor so far as we can gather from the chief men hereabout, has there been any these 40 or 50 years; the old men remember such a man, who, they say, was a tyrant, would take as many wives as he pleased, and allow them but one, and therefore they cut him off; this derogates much from the reputation of the history of the buccaneers; if there was such an emperor among them, he was an *Indian* made so by themselves.

This country certainly affords gold enough; for besides that the natives constantly assure us, that they know several gold-mines on this side; the plates they wear in their noses and the quantity of other gold they have among them, is enough to convince any man of the truth thereof; there were aboard here one night some *Indians* that had an 100 ounces of gold about them; our circumstances are very good in some respects; for we have advice by the way of *Portobello*, that there is a great rebellion in *Mexico*, and Captain *Diego* and all the *Indians* about him are at war with the *Spaniards*; Captain *Ambrosio* is going to his assistance, which will divert them on that side, but what is best of all, we are now in a posture of defence against all the *Spanish* forces

forces in *America*: We have already ſeen *Dutch*, *French*, and *Engliſh*, all at the ſame time in our harbour, who all wondered what the reſt of the world have been doing, to ſuffer us to come to the beſt harbour in *America*; captain *Long* came in 8 days after, to whom we believe we were a great eye-ſore, tho' he ſaid nothing; he commanded the *Rupert Prize*, a ſmall *Engliſh* man of war fitted out by the king, but upon what deſign we know not; only that he pretends it was to ſearch for a ſilver-wreck; he was a month on this coaſt before he ſounded it; he converſed with the natives and put men aſhore in ſome places to take poſſeſſion for the king of *Great Britain*, but none within 15 leagues of us; having learned from the natives that we were here, he came in his long-boat, as he ſaid, to ſee us, but we believe it was only to know the certainty of what he feared was too true: He had told all the *Indian* captains, that he came only to try their inclinations, and that there was a large fleet coming with a great many people to ſettle amongſt them and defend them againſt their enemies, he meant *Engliſh* that were to come by his direction, but our fleet coming within a month after, they all looked upon us to be the people the captain ſpoke of; ſo that whatever preſents he made them before that time, were as much for our advantage as if we ourſelves had given them.

A Polypus *of the* Lungs; *by* M. Buſſiere. Phil. Tranſ. N°263. p. 545.

A Boy 5 years of age, died at *Kenſington* of a conſumption; a year before he died he was troubled with a dry cough, which continued ever after, ſpitting now and then a little blood; 10 or 12 days before he died, his nurſe took notice of ſome thick skin, as ſhe ſaid, he ſpit out; his phyſician having examined one of them, found it had the conſiſtence and ſhape of a veſſel, which made him think it might perhaps be ſome veſſel of the lungs; the child being dead, he opened his body, and found the *Omentum* quite deſtitute of fat, as were alſo all the other parts, and the glands of the meſentery were hardened and blackiſh; in the left ſide of the lungs he found a little purulent *Sanies*; the inſide of the *Trachea* or wind-pipe was incruſtated with a ſlimy membrane, inſomuch that that pellicle made a perfect veſſel from the larynx to the very extremity of the *Bronchiæ*, from which it eaſily came off without breaking either the trunk or branches: The Dr. obſerved that it adhered to the inner coat of the *Trachea*, only by ſome ſmall filaments, which were ſo tender as to be eaſily broken off, which made the Dr. think that the production of

that extraordinary veſſel, was nothing but the mucilaginous humour, which is continually diſcharged by the glands of the *Trachea*; and being grown more clammy by the diſtemper, was reduced to a kind of jelly by the dryneſs of the air, whereby not being able to ſpit it out, it incruſtated the inſide of the *Trachea* and *Bronchiæ*, and growing thicker, was at laſt ſhaken off by the violent fit of coughing the child was ſometimes taken with, and then it was again renewed by the ſucceeding *Mucus*; this new veſſel would not diſſolve in hot water; the veſſels of the lungs, that is, the *Trachea* and *Bronchiæ*, the pulmonary arteries and veins were all ſound and entire.

The Circulation and Globules of Blood in Butts; *by* M. Leewenhoeck. Phil. Tranſ. N° 263. p. 552.

M. *Leewenhoeck* having ſeveral times examined butts, ſome of which, bating the tail, was but an inch long with a magnifying-glaſs, in order to ſee the circulation of the blood, and the variety of its motion; he again conſidered thoſe little particles which conſtitute the blood of a red colour, which he formerly aſſerted to be flat and oval; the greateſt motion of the blood obſervable thro' the fins, was on each ſide of the various little ſingle bones placed therein, where the blood-veſſels were ſo large, that 25 of the abovementioned particles could paſs a-breaſt, but diſappeared as they drew nearer to the extremity of the fins, ſmall veſſels being all along detached from the arteries; on one ſide of a little bone runs an artery, and on the other a vein, correſponding thereto; and beſides, he obſerved a vein and an artery lying ſo cloſe together, as if their coats had been united; from the abovementioned artery there aroſe ſmaller veſſels a-croſs the membrane between the little bones, and after they had run out the breadth of three or four hairs, they united again into one vein; theſe ſmall veſſels receive about two or three particles of the blood at once, eſpecially if the fiſh lies ſtill; and conſequently its little bones cloſe to each other, when it exerciſes its fins in ſwimming, the diſtance between the little bones is enlarged, the interjacent membranes ſtretched out, and the blood-veſſels that run a-croſs them, eſpecially thoſe in the tail-fin, are drawn out ſo, as to be twice as long as before; M. *Leewenhoeck* finding it eaſy to extend the tail-fin, he accordingly ſtretched it to a breadth equal to what the fiſh gives it in ſwimming, in order to obſerve the motion of the blood in the thus extended veſſels; he found, that whereas, when the fiſh did not move, the ſmall veſſels

veſſels received two or three particles in a breaſt; the ſame veſſels now ſtretched out with the tail-fin which they run a-croſs, did not only admit no more than one particle, but likewiſe theſe particles did not move ſo faſt as in the veſſels when not extended; and in ſome places theſe particles were at ſuch a diſtance, that one or two more might lie in the intervals; in this obſervation he could not find that the particles were perfectly oval, but met with them ſometimes round, and ſometimes of a ſhapeleſs figure; the occaſion of which, M. *Leewenhoeck* takes to be this; the little veſſels being ſtretched to an unuſual length, become narrower and conſequently the particles contained therein being very pliant, are preſſed and ſqueezed out of their circular form; for further ſatisfaction, he cut off a piece of the tail from ſeveral little butts, in order to view the blood out of the veſſels, not being ſatisfied that the particles in the blood of fiſhes were naturally oval, but that in their perfect ſtate they came nearer to a round than an oval form; proceeding upon this poſition, that the particles of the blood of fiſhes conſiſt of ſix ſmall globular bodies as well as thoſe of men and other animals; having obſerved ſeveral particles broken into four, five and ſome into ſix pieces; and what was very remarkable was, that particles, which were oval, and of other figures became roundiſh, and at laſt perfectly round; to trace the matter further, he took the blood running from a live ſalmon, when cut in pieces, and put it into a glaſs-tube no larger than a ſmall quill; in a ſhort time the blood in the tube congealed, but when it become partly fluid again, he put it into a ſmaller glaſs-tube, and having placed it before his eye, the particles being in motion, ſome of them appeared of a flat oval figure, and others, which preſented themſelves to the eye ſide-ways, ſeemed a little thick, and thoſe whoſe ſide did not directly face the eye, ſeemed a little broader, without the leaſt appearance of any globular form; the blood of a ſalmon appears blackiſh, by reaſon of a greater number than ordinary of red particles; M. *Leewenhoeck* put ſome of the ſame blood upon a very clean glaſs, and where the particles lay thin, he perceived them oval, nay in ſeveral ovals he deſcried globules, and in ſome few, ſix globules; where theſe little globular bodies were crowded upon one another, the particles of the blood were congealed together, ſo that no ovals could be diſcerned; nay, the particles ſeemed to be huddled up together, ſo as that ſix of them had made a compound body: M. *Leewenhoeck* affirms, that he has

has ſeen the blood circulate in veſſels ſo ſmall, that if a particle of ſand was divided in 1000000 parts, one of theſe parts could not paſs thro' the blood-veſſel, tho' ſuppoſed as pliable as a particle of blood: He tried all poſſible means to diſcover the oval particles of blood, when it circulates freely in the veins; and for that end he pitched upon the ſmalleſt blood-veſſels, but notwithſtanding the niceſt enquiry he could make, he could not be ſatisfied upon that point; for ſometimes he met with an obſcure dark particle, and ſometimes with a much clearer one; and when he caſt his eye upon the ſmalleſt veſſels in which the blood did not move, and ſeveral veſſels that he diſcovered upon the extremity of the fin, the particles were quite deſtroyed, ſo that he ſaw nothing but a ſimple ſtagnating liquor, a little tinctured with a bilious colour.

Plate XIII. Fig. 24. A B C D repreſents the oval particles of a ſalmon, that weighed above 30 pounds; A B repreſents the particles that appeared flat and broad, but did not face the eye directly; thoſe about C came ſtreight upon the eye, and for the moſt part had a little clear ſort of a light in the middle, larger in ſome than in others; theſe particles are heavier than the ſerous liquor, in which they ſwim, and which together with the particles conſtitutes the blood.

M. *Leewenhoeck* likewiſe put upon a magnifying-glaſs the blood of a very ſmall butt, which was not mixed with any liquor; only the particles lay in their *Serum*, which are repreſented Fig. 25. between E and F.

Theſe particles, which are diſtinguiſhed by little ſhining ſpots in the middle, are delineated Plate XIII. Fig. 26 between G and H: Moreover M. *Leewenhoeck* put the blood paſted upon a glaſs to a greater magnifying-glaſs, the thinner moiſture ariſing from the ſerous matter, and the oval-like blood being exhaled; ſo that ſome ſmall oval particles were to be ſeen, that were ſo far from running into each other, that they did not touch, and plainly ſhewed that they conſiſted of ſix little globular particles repreſented in Fig. 27 between I and K.

In purſuance of this new obſervation, M. *Leewenhoeck* viewed the circulation of the blood with glaſſes that magnified ſtill more than any he had hitherto uſed, and ſo he plainly made out the oval particles; now the greater the magnifying glaſs is, the ſwifter does the circulation of the blood appear in the veſſels; and having retarded this motion, he employed two or three ſeconds of time in obſerving the little veins; and he found that in ſeveral ſmall veſſels the oval particles were broke

broke ſo, that he could neither ſee them nor thoſe, of which ſix conſtituted a particle of blood, but only a ſimple fluid of a faint colour running along the veſſels; but in a large artery at the tail, the blood moved ſo ſlowly, that he could eaſily diſcern the particles were oval; nay not only ſo, but he likewiſe perceived more clearly than before, the globules that conſtitute the oval particles, if not always, yet at leaſt for the moſt part: For it is eaſy to conceive how ſix little globules, which are pliant, always in motion, and driven one upon the other, ſhould unite in the faſhion of a bowl; thus Plate XIII. Fig. 28, repreſents the firſt coalition of the ſix little globules into one: M. *Leewenhoeck* made up ſuch a globe as the laſt figure repreſents of ſix wax balls put together, to ſhew the form and compoſition of the little globular particles of the blood; and beſides, he is perſuaded that each of theſe little globules of blood is at leaſt compounded of ſix and thirty others; theſe little balls being moved, and ſqueezed together, and being at the ſame time pliant, and compacted into one compleat round form, are repreſented Fig. 29.

From ſuch a ſcheme we may conceive how the globular parts of men's blood, and other animals acquire a roundneſs; but how the oval particles are compounded of ſix globules is not ſo eaſy to apprehend; and ſhould we divide one of theſe globules by our imagination into ſmaller and ſmaller parts, the little particles that enter into the compoſition will ſtill be inconceivably ſmaller; yet ſuppoſing we could diſcover the figure and ſhape of parts leſs than a globule of blood by a 1000,000,000, M. *Leewenhoeck* thinks we would ſtill be far from reaching the firſt conſtituent parts: As he aſſerted above, that the particles of blood are by a preſſure disjoined and united with the fluid matter in which they move, ſo that the whole appears as a ſimple fluid liquor; in like manner we may eaſily imagine, that when a horſe ſtrains, and compreſſes his breaſt in drawing a heavy load, the globules of blood are diſſolved in the midſt of the veſſels, where the greateſt preſſure is, and are as it were confounded and united with the *Serum*: M. *Leewenhoeck* thinks, that perhaps the diſſolved particles, when freed from the abovementioned preſſure, may return to their former figure; juſt as when a piece of fat is laid in ſuch a heat, that its particles, which nearly reſemble the globules of the blood, are diſſolved by the fire, and turn into a clear cryſtalline liquor, viſible by a magnifying-glaſs; and as ſoon as the melting heat is gone from the fat, it preſently returns to

its

its former globular parts; and this will happen whenever it is cold again, tho' melted ten times or oftner.

That venous blood may become arterious without being firſt in the heart, appears by the following experiment; ſuppoſe AB in Fig. 30. to be a vein, in which the blood looked upon thro' a magnifying-glaſs, paſſes with great celerity from B to A; from this vein run two ſmall branches C and D, which unite between E and F; now ſuppoſing HI to be an artery, in which the blood moves upwards with equal ſwiftneſs from H to I; out of HI ariſes a venous ſpring delineated in KFL; the blood moving from K to F joins the other in F; and by this means part of the blood coming from the artery is thrown into the vein, as paſſing from F to G; and to the beſt of M. *Leewenhoeck*'s obſervation, a quantity of blood juſt equal to that carried from KF to G, moves from CE to F, and directs its courſe upwards from F to L; ſo that whatever arterious blood paſſes thro' FK and FG, an equal quantity of venous blood returns thro' CE and FL: Tho' the agreeable variety of the blood's motion was formerly apparent; yet this experiment afforded M. *Leewenhoeck* a very clear perception of the above-mentioned variety; and beſides, this union of the blood-veſſels was not formerly diſcovered.

M. *Leewenhoeck* viewed the ſeed of two cocks that were not yet arrived to their full growth, in order to trace, as much as poſſible, the length and ſingular narrowneſs of the tails of the little animals in the male ſeed; but he could not compaſs his end, tho' he tried them ſometimes living and ſometimes dead; however he is certain, that the leaſt of the tails of thoſe animals is more than 10000 times leſs than a hair upon his hand; tho' he cannot ſay that he ſaw it diſtinctly.

Roman Antiquities *in* Lincolnſhire; *by Mr.* Abraham de la Pryme. Phil. Tranſ. N° 263. p. 561.

MR. *de la Pryme* obſerved ſeveral *Roman* ways in *Lincolnſhire*, but none more remarkable than that commonly called *High-Street*, which he thinks runs almoſt directly in a ſtraight line from *Lincoln* to *Humber-ſide*; this ſtreet is caſt up on both ſides with incredible labour to a great height, and diſcontinued in many places, and then begun again, and ſo on to the *Humber*; he obſerved, where it runs over bare mould and plain heath, that there it conſiſts of nothing but earth thrown up, but where it comes to run thro' woods, there it is not only raiſed with earth, but alſo paved with great ſtones ſet edge-wiſe, ſo very

very close to each other, that the roots of the trees, that had been cut down to make way for the same, might not spring up again and blind the road; this paved causeway is still very strong, firm, and visible in many places of this street, where woods are still standing on both sides, as undoubtedly they were in the time of the *Romans*, else it had not been paved; and in other places it is paved, where nothing of any wood is now to be seen, tho' undoubtedly there was, when it was made; in one place he measured the breadth of the said paved street, and he found it just seven yards broad, *English* measure: This street or causeway in its course full north as aforesaid, runs by the fields of *Hubberstone*, which perhaps signifies the place, where the *Danish* General *Hubbn* was buried) in which fields, not far from this street, is the foundation of many *Roman* buildings to be seen, as is manifest from the tiles found there, and according to tradition, there has been a city and castle in that place; and there are two springs, the one called *Julian*'s stony well, and the other *Castleton* well; and several old *Roman* coins are now and then found there; this might possibly be some little old *Roman* town by the high-way side, and was perhaps in after times, before it was ruined, called *Castletown* or *Casterton*, from its being built upon or hard by some of their camps, that might then be in those fields; about a mile further to the northward on the west side of the said street, upon a great plain or sheep-walk, the foundations of another old town are very visible; tho' now there are neither house, stone, rubbish, tree, hedge, fence or close to be seen belonging thereto: M. *de la Pryme* counted the *Vestigia* of the buildings, and found them to amount to about 100 that are still visible; and the number of the streets or lanes are 4 or 5; and not far from it northward is a place called the *Kirk-garth*, where the church is supposed to have stood, that belonged to this town; tradition calls this place *Gainstrop*, and Vol. II. *Monast. Angl.* shows that there were lands and tenements herein, given to *Newsted Priory*, not far off from this place, in an island in the river *Ank*, falsely called *Ankham:* About a mile or two hence, the street runs thro' *Scawby Wood*, where it is all paved, and from thence close by *Broughton*, by a hill which M. *de la Pryme* would take to be a barrow, from which the town had its name, *quasi Barrow-town*; however he found fragments of *Roman* tile and bricks there, besides many petrified shell-fish, several of which he broke, to view their texture, and see whether he could find

one within another; the cauſeway all along paved from thence is continued about a mile further to the entrance upon *Thornholm*, where there is a place hard by the ſtreet called *Bratton Graves*, and a little to the eaſt near *Broughton* wood-ſide, is a ſpring that turns moſs into ſtone; and a little farther ſtand the ruins of the ſtately priory of *Thornholm*, built by king *Stephen*; oppoſite to this priory, about a quarter of a mile on the weſt ſide of the ſtreet, is a place called *Santon*, from the flying ſands there, which have over-run above 100 acres of land; amongſt theſe ſands there was in ancient times a great *Roman* pottery, as Dr. *Liſter* has ſhewn from the reliques of ruinous furnaces, and from ſeveral fragments of *Roman* urns, and pots ſtill to be met with; M. *de la Pryme* alſo found there ſeveral *Roman* coins, and a large piece of braſs was found in the bottom of one of the furnaces like a croſs, which perhaps was part of a grate, to ſet ſome pots on, while they were baking or drying; returning back to the ſtreet, there are ſeveral ſand-hills ſomewhat like barrows, on the top of one of which was erected a large flat ſtone, now ſo far ſunk in the ground, that there is not above a foot of it to be ſeen; but he could obſerve no inſcription thereon, tho' undoubtedly it was not ſet there to no purpoſe; then entering into *Appleby-lane*, the ſtreet leads thro' the weſt-end of the town, where two old *Roman* games are ſtill practiſed, tho' very imperfectly, the one called *Julian*'s bower, and the other *Troy*'s walls; from hence the ſtreet runs ſtraight on, leaving *Roxby*, (a little town, half a mile to the weſt) and *Winterton*, a pretty neat town; and then about 3 or 4 miles further, leaving *Wintringham* about half a mile to the weſt, the ſaid ſtreet falls into the *Humber*, and there ends, where there has been a town called old *Wintringham*, and a ſort of a beach for ſhips: All this part of the country on the weſt ſide of this ſtreet, has been formerly poſſeſſed by the *Romans*, as may be gathered from the medals, coins, and ſeveral *Roman* tiles and bricks that are commonly found here, eſpecially at a cliff called *Winterton-cliff*, where ſome *Roman* buildings have ſtood; and further about two miles more to the weſt is *Alkburrow*, which ſeems to have been a *Roman* town, not only from its name, but alſo from a ſmall ſquare camp or entrenchment there, on the weſt ſide of which is a barrow called to this day *Counteſs-barrow* or *Counteſs-pit*, hollowed in the middle.

In the town of *Roxby* is a cloſe, or garth, where a *Roman* pavement was diſcovered, on the ſouth-weſt of the church; the occaſion of its diſcovery was this; one *Thomas Smith* digging to repair a fence between this cloſe and another, as ſoon as he had diſ-

discovered it, he bared a little thereof, and it lay about a foot and a half in the ground; and upon digging in several places, he found it about 6 or 7 yards broad, and as many long, if not more; M. *de la Pryme*, having got a spade, shovel, and broom, fell to work, and with a great deal of trouble (the ground being very hard) he bared about a yard and a half square, by which means he cast up several pieces of *Roman* tile, the bone of the hinder leg of an ox or cow broken in two, and several pieces of plaister painted red and yellow, which seemed to have been the cornish at the foot of some altar, or else perhaps of some part of the building; and he observed that several large stones in their fall (when the building over this pavement was destroyed) had broken and lodged themselves in the pavement; then having swept the thus cleared space very clean, the pavement looked exceeding beautiful and pretty; and one could not imagine, that such mean stones could make such beautiful work; being nothing but small square bits of brick, slate and cauk, set in curious figures and good order, and only of three colours, red, blue and white; several whole rows of red, blue and white on the outside of the smaller work, consisted of pieces twice as long as any of the rest; the materials that these small stones are set in, is a floor of lime and sand, and not plaister, which floor is so rotten and decayed with time, that the little stones, *&c.* are easily dug up. The whole pavement consists of circles, quadrangles and several irregular figures, with rows of the aforesaid stones, red, blue and white; in some of these circles there were urns; in others flowers; and in others again interchangeable knots, according to the fancy of the workman.

Observations in Italy; *by Dr.* Peter Sylvester. Phil. Trans. N° 264. p. 627.

DR. *Sylvester* took notice in the university of *Bononia* of the following inscription made in commendation of the famous *Malphighi*.

D. O. M.

VIRTUTI & famæ in ævum mansuræ inclyti viri M. Malpighii, medicinæ professoris celeberrimi, utraque artistarum universitas P. anno salutis, 1683.

And a little lower.

Miraris breve lemma? Nomen ingens ornari negat; est satis referri; jussum cætera tacere marmor; omnis Malpighium loquetur ætas.

The Dr. made the following obſervations on the *Bronchoceles*, a diſtemper very frequent all over *Lombardy* and *Savoy*; by the diſpoſition of this tumor, he is ſatisfied it has principally its ſeat in the *Glandulæ Thyroideæ*, and ſometimes too, but very ſeldom, in the *Parotides Conglobatæ*, which laſt he could plainly ſee were no ways concerned in the preſent caſe, as he obſerved in ſeveral *Bronchoceles* of a very great bigneſs; he thinks that theſe tumors (generally attributed to the water the people drink being melted ſnow) proceed from the viſcidity of the *Lympha*, which by degrees extends the membranous coats of the glands, and being there congealed, hardens them to that degree, that an inveterate *Bronchocele* is almoſt like a ſtone; but it is difficult to give a good reaſon why theſe ſwellings are to be ſeen no where elſe, but in theſe glands of the neck; it is probable that the natural conformation of the *Glandulæ Thyroideæ* (which being of a harder and more ſolid ſubſtance than other glands, ſooner ſtop the viſcid *Lympha*) is the occaſion of this tumor's always beginning and ſettling there. The *Sal Montis Veſuvii* is found in pretty large lumps, after that mount *Veſuvius* has thrown out vaſt quantities of aſhes; the great rains that fall upon theſe aſhes make a ſort of lee, which, being lodged in hollow places, are evaporated by the heat of the ſun, and there remains behind this urinous ſalt, whoſe taſte is ſomething like ſal-armoniac.

At the *Sulfatara*, between *Naples* and *Puzzolo* they make allum in the following manner; in the ſummer-time they gather as much earth, as they have occaſion for, which is in the middle of a large area, and they keep it in a dry place; afterwards they put it into lead-kettles of a pretty good thickneſs, and pour rain-water thereon, which is alſo impregnated with the ſame mineral; for which purpoſe, they take care to dig ſome large pits, to preſerve the rain-water, which they convey into a large ciſtern hard by the kettles; they take away the earth when the *Lixivium* is made, and as it grows ſtrong by evaporation, they put it from one kettle into another, till it is ſufficiently evaporated; then they take it out, and convey it into a wooden tub, where after it has cooled, you ſee the allum ſtick to the ſides of the veſſel, in the form of cryſtals; but the moſt remarkable thing is, that theſe kettles are ſet upon ſome of the large *Spiracula*; where, without any expence of fuel, only by the violent heat of theſe *Effluvia*, the evaporation is conſtantly made ſufficient for the cryſtalization; all this laboratory, where the kettle, ciſtern, and tubs are, is only tied over; the governors of the great hoſpital of the *Annunciata*, who have been at the charge of this

this ingenious contrivance, do make now about 3 or 400 pounds a year by it: All ſummer long ſome labourers dig up and down in ſeveral places of the ſame area, as in a kitchen garden; by which means they give way to the copious ſulphureous ſteams, that are within the bowels of this mountain; and out of the ſuperficies of this earth, by means of earthen pots, they ſublime the brimſtone: At the mouth of the largeſt *Spiracula*, where there is an exceſſive heat, together with a conſtant noiſe and ſmoke, is found a ſort of native ſal-armoniac; it ſeems the ſteams ariſe in a liquid form; for if you put in a key, ſword, or any thing ſolid, theſe *Effluvia* will ſtick immediately to it and drop off like water: All this mountain muſt be very full of mineral ſubſtances; for when the *Effluvia* are ſublimed to the top of the *Spiracula*, they are ſeen ſticking there to tiles or ſtones, where they form this ſalt, of which they gather yearly about 200 pound weight; it has much of the taſte of the factitious ſal-armoniac; and, as an ingenious phyſician told Dr. *Sylveſter*, being diſtilled in a ſand furnace, it yields a volatile urinous ſpirit, altogether like ſal-armoniac, both as to its ſenſible qualities and all other effects; the Dr. only obſerved that the ſpirit had ſomething alluminous in it, to correct which, they add a greater quantity of quick-lime or ſalt of tartar, than in the diſtillation of the common ſpirit.

The Catacombs *at* Rome; *by Mr.* James Monro. Phil. Tranſ. N° 264. p. 643.

THE catacombs at *Rome* are a narrow gallery dug and carried a great way under ground, with a vaſt many others going off from it on all hands, and alſo a vaſt many little rooms going off from the principal and the ſecundary ones too; thoſe of *San Sebaſtiano*, *San Lorenzo* and *Sant Agneſe*, and thoſe in the fields a little off from *Sant Agneſe* are commonly ſhewn ſtrangers; they take their names from the churches in their neighbourhood, and ſeem to divide the circumference of the city without the walls between them, extending their galleries every where under it, and a vaſt way from it, ſo that all the ground under it, and for ſeveral miles about it, is ſaid to be hollow: Mr. *Monro* ſaw the catacombs at *Naples*; and they ſay there are catacombs in the neighbourhood of all the great towns of that part of *Italy*; ſome authors will have them made by the primitive Chriſtians; adding, that in the times of perſecution they lived, held their aſſemblies, and laid up the bodies of their martyrs and confeſſors therein; this is the account that prevails at *Rome*, and in conſequence of it men are kept conſtantly at work therein; as

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ſoon as theſe labourers diſcover a repoſitory, with any of the marks of a ſaint about it, intimation is given to the cardinal treaſurer, who immediately ſends men of probity and reputation to the place; where they find a palm painted or engraved, or the cypher X p (which is commonly read *pro Chriſto*) or a ſmall round projection in the ſide of the gallery, a little below the repoſitory, what is found within it is carried to the palace; Mr. *Monro* ſaw ſeveral of theſe projections open, with pieces of vials therein; the glaſs indeed was tinctured, and it is pretended, that in theſe vials was preſerved the blood of the martyrs, which was thus laid up near their bodies towards the head, to diſtinguiſh them from thoſe of others, who were not called to the honour of laying down their lives for the faith of the goſpel; after the labourers have ſurveyed a gallery, they cloſe up the entry that leads thereto; ſo that moſt of them are ſhut; and there are not more left open, than what is neceſſary to keep up the trade of ſhewing them to ſtrangers; but to this opinion it may be juſtly excepted, that allowing the catacombs to be proper for the end for which they are preſumed to be made, and that the Chriſtians of that age were in a capacity of making that conveniency for themſelves to live, and aſſemble in under ground, at a time when it was ſo very unſafe to appear above it; yet to ſuppoſe that a work of that vaſtneſs and importance could be carried on without the knowledge of the government, is ſuppoſing the government aſleep, and that that was actually done under its noſe, which muſt neceſſarily have alarmed it, had it been attempted even on the frontiers of the empire: Other authors repreſent them as a work of that vaſtneſs, that the Chriſtians in the times of perſecution had not numbers enough to carry it on; but they moſt unadviſedly confound them with the *Puticuli* in *Feſtus Pompeius*; where, at the ſame time the ancient *Romans* uſed to burn their dead bodies, the cuſtom was, to avoid expence, to throw thoſe of the ſlaves to rot; the *Roman* chriſtians, ſay they, obſerving at length the great veneration, that certain places gained by the preſence of reliques, reſolved to provide a ſtock for themſelves; therefore entering the catacombs, they made in ſome of them what cyphers, inſcriptions, and painting they thought fit, and then ſhut them up; intending to open them again upon a dream, or ſome other important incident; the few that were in the ſecret of this artifice either dying, or as the monks, who were the only men, that ſeem to have heads adapted to a thought of this nature, were ſubject to ſeveral removes, being tranſported to other places, the contrivance came to be forgotten; and thoſe galleries continued ſhut, till chance

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the parent often of great diſcoveries, opened them at laſt; thus they conclude, that the remains of the vileſt part of mankind are trump'd upon the church, for the bodies of the moſt eminent confeſſors and martyrs: But ſurely, either the catacombs are not that great work they are repreſented to be, nor to be found every where about the city, or it was very improper in *Feſtus Pompeius* to call them by the diminitive name of *Puticuli*, and confine them only to one place, which is now unknown, without the *Eſquiline-Gate: Puticuli* are holes or pits dug perpendicular in the ground, therein to throw bodies indifferently, and without any decency; and this was the conduct of the ancient *Romans*, with reſpect to their ſlaves, as implying ſimplicity, and a care to avoid greater expence; after the ſame manner when the perſecutors ſpilt the blood of ſo many martyrs, they uſed to dig holes perpendicularly in the ground, and therein throw the bodies promiſcuouſly; and of this the memory is ſtill preſerved, churches having been built in the places where the pits were made, and little monuments erected over the pits themſelves, to which the name of *Putei* is continued to this day; but what is all this to the catacombs, where repoſitories are cut, in the ſides of a long gallery, one over another, ſometimes to the number of ſeven, in which bodies were ſingly laid and handſomely cloſed up again, ſo that nothing could be obſerved by thoſe who went in, eſpecially the little rooms, in the faſhion of chappels, that have all the appearance of being the ſepulchres of perſons of diſtinction, and if they were kept in better repair, would be, without diſpute, the nobleſt burying-places this day in the world.

Mr. *Monro* thinks they were made for this end by the ancient *Romans*, in conſequence of thoſe two opinions; *viz.* that the ſhades hate the light, and love to hover about the place where the bodies are laid; they appear ſo eaſy and decent a reſting-place for the one, without the leaſt fear of being ever diſturbed, and at the ſame time there is provided a noble and vaſt conveniency, full of variety for the others, to ſolace themſelves freely and with pleaſure therein; and he thinks it will not be denied, that laying up dead bodies in caves was the original way of diſpoſing of them; this was the manner of the *Phœnicians*; and as they with their colonies peopled the weſtern parts of the world, it is more than probable, they carried it along with them, whitherſoever they came; afterwards, as men grew great and powerful, they erected noble and magnificent monuments for themſelves above ground; at length

others

others of inferior rank imitated them, leaving room enough and excluding the light; but then interring, as now practiſed in the open air and in temples, was never the manner 'till chriſtianity introduced it; of the whole we have many inſtances, and *Il Signor Abbate Bencini*, *Bibliothecary* of the *Propaganda*, aſſured Mr. *Monro* in the converſation he had with him on this argument, that on the great roads in moſt parts of *Italy* little catacombs have been, and are ſtill found under ground; and that it was the cuſtom to build little houſes over them; and as to the marks of a martyr, he added that they do not conclude much, and that the ſo much famed cypher X P was in uſe amongſt the ancients long before Chriſtianity, and that it was the two *Greek* letters XP, under which ſomething myſtical was comprehended; but that he met with no author that gave any account what the myſtery was: This thought ſeems to be very natural, as ariſing from the ſole theory of the place, and falls in ſo appoſitely with the religion and practice of the ancients, among whom the *Dii Manes* were the tutelary gods of the country; and D. M. at the head of an inſcription argues that the moles, the ſepulchre, the monument, *&c.* was in the primary intention made for and dedicated to the ſoul; upon the ſame maxims, when a hero died or was killed in foreign expeditions, as the body was liable to a quick corruption, and for that reaſon unfit to be tranſported entire, they fell on the expedient of burning, in order to bring home the aſhes, to oblige the *Manes* to follow, that ſo the country might not be deprived of the benefit of its tutelage; this Mr. *Monro* thinks was the original of burning, which by degrees became more and more univerſal, till at laſt the pomp and magnificence of it reconciled it to all that were able to go the length of the expence: As for the prejudice of the ſilence of ancient authors in this matter, it is eaſily removed, and to be regretted at the ſame time that the authors of all ages too much neglect the cuſtoms of their own times; by theſe means the ancient cuſtoms, with the time and reaſons of their diſuſe are entirely loſt.

Upon the whole, Mr. *Monro* thinks, that the catacombs were the burying-places of the ancient *Romans*; at length the manner of burning, which they received from the *Grecians*, coming by degrees to prevail univerſally, they fell under a total neglect; this is the ſtate in which the primitive Chriſtians muſt be ſuppoſed to have found them; and therefore they laid up the bodies of their dead here; and perhaps when the perſecution

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was hot, concealed themſelves, and kept little ſeparate aſſemblies in theſe chambers; at laſt, the empire becoming chriſtian, they fell again into the old ſtate of neglect, in which they continued, until they came to be looked and ſearched into.

The Libella, *by M.* Poupart. Phil. Tranſ. N° 265. p. 673.

THE *Libella* is a flying inſect called in *France Demoiſelle*, from the variety of its colours, tranſparency of its wings, and its ſtately flight; they alſo call it *Pearls* from the figure of its head, or rather from the roundneſs and colour of its eyes; it is divided from ſpace to ſpace into rings, by means of which it compoſes angles with its body whoſe lines it can make longer or ſhorter, as it finds occaſion: Theſe different ſections ſerve to the motion of this inſect, as we know the tail doth in birds; and as they are lengthened or contracted, they convey themſelves at pleaſure, the point or centre being fix'd between their wings: All modern naturaliſts know, that the greater ſort of *Libellæ* are generated under water, being wrapt up in a membrane which at length diſſolves: When the young *Libella* is ready to quit its caſe, it dilates its belly, that the water may enter at the *Anus* into the inteſtines; then it compreſſes itſelf, in order to make this water circulate, which it expels and ſhoots out a great way; it receives more water into its inteſtines, and ejects it in the ſame manner; and it continues this action with great force for ſome time, and makes the water circulate: In order to ſatisfy himſelf that it took in the water at the *Anus*, and not at the mouth, M. *Poupart* put a *Libella* upon his finger, which he held faſt by the legs; he plunged it under water with his head downwards, the *Anus* being in a level with the water, ſo that it might get into the inteſtines, and this water it ejected a great way; he drew his finger a little further out, ſo that the water could not enter at the *Anus*, and the fly continued its motion, but ejected no water: M. *Poupart* thinks, that the animal does this, in order to cleanſe its body from all excrements in that element where it leaves its old robes, to appear in a more glorious, and new form in the open air: There are a great number of ſmall veſſels, which cloſely unite the body of the *Libella* in its caſe; it is neceſſary that theſe be dry, that they may the ſooner break, when it makes its efforts to get out of its caſe, which cannot happen, as long as there is any aliment in the inteſtine to afford nouriſhment to the caſe, and its ſtrings; and perhaps

this is the reaſon, why no inſects will take any food, when they are going to change their forms; and if they do not cleanſe themſelves as the *Libellæ* do, yet they ſtay a great while longer, before they change, without any aliment: The *Libella* is not longer than half a day in quitting its caſe, and taking its flight.

To know the cauſe of its exceeding ſwift and whirling motion, you muſt cut the ſkin of the *Libella*, which is very fine, all along the back, and be ſure to carry the point of the ſcizzars upwards, leſt you cut the interior parts; you muſt alſo draw the ſkin to the right and left hand, and fix it with pins upon a table, in order to diſcover the 16 muſcles, which lie between the legs and wings (eight on each ſide) of the thickneſs, length, colour, and almoſt the ſhape of a grain of barley, contiguous to each other, and without any adheſion; you may obſerve, that each muſcle is compoſed of many fleſhy fibres, which do not ſeem to be joined together, but terminate round at the ends of the muſcle, where they compoſe a common tendon; ſo that one might diſcern any of theſe fibres to be a ſmall muſcle, of which the chief muſcle is compoſed; the uſe of theſe muſcles ſeemed to M. *Poupart* very particular; for the ſame muſcles which ſerve to flutter the wings, ſerve alſo to move the legs; the upper tendons of the muſcles enter into the wings, the ſame, he thinks, as compoſe the fibres, and the lower enter a good way into the legs; yet the contrary motions of theſe organs are not at all hindered; for as long as the wings play, the feet lie ſtill, and ſerve for a prop to the muſcles, which move the wings; and when the feet are in motion, the wings lie ſtill, and in their turn ſerve to ſupport the tendons, which direct the feet: The eyes are like two oblong thick pearls, which begin at the fore-part of the head, and end in the hinder-part; their outward membrane is dry, thin, and tranſparent, and encloſes a ſmall ſoft ball, filled with a very black liquor; two ſmall canals filled with air, enter into each of theſe eyes, and run along to the great channel, which is alſo furniſhed with air, and accompanies the inteſtine from the head to the tail; this ſtructure made M. *Poupart* think, that the *Libella* could derive the air, contained in theſe canals into the eyes, to give them a greater convexity to view objects that are very near; and on the contrary, the air is forced out of the eyes again, to flatten them, when they look at remote objects; and this conjecture is not altogether groundleſs; for M. *Poupart* having blown into the thick canals, which are about the middle of the body, the eyes became conſiderably tumified, and by letting the air return, they became flat again; if a *Libella* is left dead for ſome days, the inward parts

parts will putrify and come to nothing; but these canals will remain entire, and as firm, and solid, as they were before.

Fossile-shells *and* Fishes *in* Lincolnshire; *by Mr.* Abraham de la Pryme. Phil. Trans. N° 266. p. 678.

IN a quarry at the east-end of *Broughton* in *Lincolnshire*, is found a clayey substance, or earth, that lies under the stone, in which are innumerable fragments of shells of fish of various sorts; *viz. Pectinites*, *Echini*, *Conchites*, and others, with some pieces of cornel; and there are sometimes found entire shell-fish with their natural shells on, in their native colours, yet cracked, bruised and broken, and some totally squeezed flat by the weight of the earth; that according to M. *de la Pryme*, still lies, and was cast upon them at the deluge: There is another quarry in the field on the south-side of the town, of a hard blue stone, which was certainly a pure fine blue clay, in some antediluvian lake; amongst the stones of many of which are innumerable petrified shell-fish of various sorts, but so united to the stone, that it is very difficult to take them out whole, and he always found that they lay in the superficies of the quarry, within a foot of the top, and few or none deeper; in several places of the surface of the quarry (which looks rugged and drifted, as snow does after a storm) there are several shell-fish, half in and half out of the stone; that part, which is within the quarry, is entire and whole, but a hard stone; and that part which is without, which the petrifying effluvia did not touch, is consumed and gone, all but a little of the edges, which are plain shell, and have all the *Radii* and *Striæ*, that the shells of those sorts of fishes commonly have: All these fish have their shells on; some of which are exceeding thin, to what others are; sometimes the shells are in their petrifaction so thoroughly united and incorporated with the stone, that they are scarce visible; others in the same quarry have a thick white shell petrified, but not incorporated and turned into the substance of the bed, in which they lie; in getting out the fish, all the shell sticks so fast to the rock, that most commonly it is left behind; but sometimes the shell cleaves in two, one half of the shell on both sides of the fish stick thereto, and the other half to both sides of the bed; but others are brought out by lying in the air in frosty nights, with the whole natural shell on, and the *Radii* or *Striæ* very exact; there are other fishes here, that have a smooth black shell on, with several *Striæ*, but no *Radii*, very like, if not the same with the *Concha Nigra Rondel.*

M. *de la Pryme* has alſo ſeen in this quarry ſome ſhell-fiſh half open, and filled with the matter of the bed, wherein they lie and petrified therewith; others being in heaps together, he found ſome of them broken, others bruiſed, and the edges of one fiſh thruſt into the ſides of another; ſome with one ſhell thruſt half way over the other, *&c.* and thus petrified in the bed together; others have been ſo cloſe together in the ſame bed, that the matter of the bed could not inſinuate itſelf into them; ſome of theſe that are thus found are wholly empty, others are filled with cryſtalline fluors, tho' ſuch are not very common; ſome M. *de la Pryme* ſaw half full of the ſaid bluiſh clay of the bed, and half full of the ſaid cryſtallizations, which proceeded from ſubterraneous heat and effluvia; amongſt the fiſh in this quarry, he had ſeen ſeveral large horſe-muſcles, ſuch as breed in freſh-water rivers and ponds, which are exactly like the *Concha Longa Rondel.* but are thicker and fuller than they commonly are; this largeneſs proceeds from the fertility and fatneſs of the bed, where they breed; and in an old pond near *Broughton-hall*, he found ſome of the largeſt of this ſort of ſhell-fiſh he ever ſaw; as if this ſoil was the propereſt for breeding them of any elſe; juſt as the *Cornu Ammonis*, *Nautili* and others breed beſt upon allum ſoil; which is the reaſon they are found ſo much at *Whitby*, *Rochel*, *Lunenburg*, *Rome*, and other places, where there are allum-mines; and to find any of theſe ſorts of fiſh (which ſome learned men have thought to be totally loſt) they might probably find them upon allum-ſoils in the ſea.

Others have an ouzey ſoil, a ſort of mixture of ſeveral ſoils, as part of the country about *Frodingham*, *Bramber*, *Aſhbee*, *Botſworth*, &c. ſeems to be; in the fields and ſtones of which towns is one particular ſort of fiſh, which he does not know what *Genus* or ſpecies to compare it to, bending ſomewhat like a ram's horn, and exactly creaſed on the outſide like one, with an *Operculum* or lid thereon, which the fiſh opened and ſhut, as it had occaſion; the bed wherein this fiſh bred, in the antedeluvian ſea (as he ſuppoſes) is not above a foot thick, in which, but eſpecially in the ſuperficies, are millions of the ſaid fiſh ſticking half in and half out of the ſtone; whoſe ſhell being moſt durable, that part which ſticks out, is not conſumed, as that at *Broughton*, but remains whole and entire; and M. *de la Pryme* had ſeen whole heaps of them, that by ſome great weight falling upon them at the deluge have been ſhattered to pieces, and ſo petrified in the bed where they lay: In the pariſh of *Broughton* aforeſaid, he found, in the looſe earth of the blue quarry, and elſe-

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where, in a whitiſh ſtone, the *Echini Galeati puncticulati Lluydii*, the *Turbinites major Lluydii*, the *Cochlites lævis vulgatior*; and in a blue ſtone the *Concha altera longa Rondeletii*, exactly correſponding to the bigneſs and draught thereof in *Geſner de Piſcibis*; he alſo found ſeveral *Belemnites* great and ſmall, perforated and flat at the root, by which they grew in the antedeluvian ſea, to ſome of which were found ſticking little ſhell-fiſh.

There have been many diſputes amongſt the learned concerning theſe appearances; M. *de la Pryme* thinks, that the antedeluvian world had an external ſea, as well as land, mountains, hills, rivers, and fruitful fields, and plants; that it was about the bigneſs of our preſent earth; and that when God had a mind, by reaſon of the wickedneſs of the inhabitants, to deſtroy it by water, he broke the foundations and ſubterraneous caverns thereof with dreadful earthquakes, by which it was for the moſt part, if not wholly abſorbed, and covered by the ſeas we now have; and that this our earth roſe then out of the bottom of the antedeluvian ſea in its ſtead; juſt as ſeveral iſlands are ſwallowed up, and others come up in their room.

From this ſyſtem of the deluge, which is the moſt conſonant with the ſcriptures of all others, all thoſe things are eaſily ſolved, which were hard and difficult before; it is no longer a wonder that ſhells, and ſhell-fiſh, the bones of other fiſh and of quadrupeds, and fruits, *&c.* are commonly found in beds and quarries, in hills and mountains, and in the bowels of the earth; as alſo, in the ſoil that was carried with great violence, and confuſion, from one place to another, occaſioned by the working of the waters, and the ferment and hurry they were put into; and as all countries were thus raiſed out of the bottom of the antedeluvian ſea and lakes, ſo that part of the country, about *Broughton*, appears manifeſtly, to have been (in the antedeluvian world) the bottom of ſome freſh-water lake, becauſe theſe are freſh-water ſhell-fiſh, which are found therein, and the bed upon which they bred, was a fine blue clay, which is the colour of the ſtone to this very day; which bed being elevated, and mix'd with other earth in the commotions of the waters, and the hurry, and confuſion that then happened, the ſaid bed, by the power of the ſubterraneous heat and *Effluvia*, was turned by degrees into ſtone, with all the fiſh therein: It may be thought ſtrange, ſeeing the ſhells are cloſe, how the matter of the bed could inſinuate itſelf into them; but this is common in like caſes; for M. *de la Pryme* has frequently ſeen, in the bottoms of ponds and rivers, where ſuch ſhell-fiſh are in plenty, that when the fiſh is conſum'd, and

and the edges of the ſhell in the mud, are as cloſe, as if the fiſh were alive; yet nevertheleſs the mud or clay will by degrees inſinuate itſelf and fill the ſame; and now, if the bottom of any one of the ſaid rivers or ponds was raiſed by an earthquake, and by petrefying *Effluvia* turn'd into ſtone, they would be found exactly correſponding with theſe: That ſeveral ſhell-fiſh ſuffered ſuch violence and force in the ſaid great flood, inſomuch as to be cruſhed, bruiſed, and ſqueezed flat, as ſome of thoſe manifeſtly are, is by no means to be wondered at, when we conſider the great pieces of riſing rocks, hills and mountains, that muſt needs roll down, and fall, in ſuch a general confuſion, as muſt needs have been in the quarry, at the eaſt-end of the town of *Broughton*; where fragments of innumerable ſhells are found, as alſo ſome ſhell-fiſh ſqueezed flat, which are all natural, and not petrified; there was by the deluge flung thereon a huge bed of a mixed ſubſtance, now turned into a whitiſh ſoft cankered ſtone, upon which were thrown vaſt quantities of earth, all which preſſed the tender ſhells ſo much, that ſome were ſqueezed flat, others broken to pieces, as they are found to this day.

M. *de la Pryme* had a hard ſtone, of the aforeſaid blue quarry, with little bits of wood coals therein, and whole leaves of *Vaccinia* or whortle-berries, ſuch as grow upon heaths; beſides, Mr. *Lluyd* has given ſeveral large accounts of whole leaves, and plants found in ſtones and rocks, and deep in the bowels of the earth; ſome folded, others plain, and ſome imperfect; all which is eaſily ſolvable, by their being, in that general hurry and confuſion, ſeized upon, and embodied in lumps of clay, and other matter; whilſt others were caught and intercepted in rolling beds of earth, as they tumbled down from riſing hills and mountains, and ſo were lodged deep in chaſms of the ground and petrified, and thus preſerved to this day.

A Cataract *in* Gottenburg *River, and the* Obſervatory *of* Tycho Brahe; *by Mr.* Gordon. Phil. Tranſ. N° 266. p. 611.

AT ſome leagues diſtance from *Gottenburg* in *Sweden*, a river of the ſame name falls down from a prodigious high precipice into a deep pit, with a terrible noiſe, and ſuch a mighty force, that the maſts, which are floated down the river to *Gottenburg*, uſually turn topſy-turvy in their fall, and often fly to pieces, when daſhed againſt the ſurface of the water in the pit; this happens, if the maſts fall ſide-ways on the water; but if they fall end-wiſe, they dive ſo far under water, that, as Mr. *Gordon* was informed, they are a quarter of an hour before they riſe

riſe again; ſome half an hour, others three quarters of an hour; and ſome a whole hour and upwards; the pit into which they fall has been often ſounded with a line of ſome hundred fathoms length, but they could never find any bottom.

The iſland *Ween*, commonly called the *Scarlet Iſland*, famous for the obſervations of *Tycho Brahe*, that renowned *Daniſh* aſtronomer, was not ſo proper for ſome aſtronomical obſervations, ſuch as taking the exact time of the true riſing and ſetting of the celeſtial bodies, together with their reſpective amplitudes; becauſe the ſenſible land-horizon of the *Ween* is extremely uneven and rugged, the northern and eaſtern parts thereof being ſome riſing hills in the province of *Schonen*, and the weſtern part is moſtly overſpread with trees on the iſland of *Zealand*; from the remoteſt of which coaſts, the *Ween* is not diſtant above three leagues.

An Aneuriſma *of the* Arteria Aorta; *by* M. Lafage. Phil. Tranſ. N° 267. p. 696.

IN the year 1685, a ſervant to the lord *Culpepper* had a fall, which cauſed a heavy ſort of pain in the breaſt for a while; about a month after this accident, a muſquet burſt in his hands which gave ſo violent a recoil againſt his right ſide, that he immediately ſpit blood, which continued for 6 months; a year after he began to feel a pulſation on that ſide, and then he ſpit blood again, which continued only in the ſpring and fall, till he died; he bled likewiſe at the noſe twice a year, for a month each time; in 1695 or 1696, a tumor began to appear under the right nipple, which growing by little and little, at laſt came to an extraordinary bigneſs; after uſing ſome emollient ointments upon it, of its own accord it broke ſuddenly, and he ſoon after died; M. *Lafaze* opened the body and found that two of the cartilages of the ribs, as alſo part of the *Sternum*, were worn off, by the continual pulſation of the tumor; the dilatation of the artery began preciſely on its trunk next the heart, before it divided itſelf into the aſcending and deſcending trunks; and tho' there is but a little ſpace, yet it dilated itſelf ſo exceſſively, that the bag filled up the whole cavity of the *Thorax* on the right ſide, and compreſſed the lungs in ſuch a manner, that they were thereby much contracted; the bag adhered by its outſide to the *Mediaſtinum*, the *Diaphragm*, *Pleura* and *Sternum*, in which it had pitted two great holes, ſuch was the force of the pulſation; the inſide of that bag was lined, almoſt all over, with bony *Laminæ*, ſome larger, ſome ſmaller, like ſo many ſhells; the heart was mightily re-

relaxed, insomuch that it was twice as large, as it ought to be; and there were some stones amongst its fibres, resembling those which are sometimes found in the lungs of scrophulous bodies.

Plate XIV. Fig. 1. A represents the heart; B the *Aorta*, next to the heart, where the *Aneurisma* began; C C the same dilated, making the bag of the *Aneurisma*; D the descending *Aorta*; E E the two axillary arteries; F F the two carotid arteries.

Fig. 2. A the heart; *b b b* the *Valvulæ Semi-lunares* in the bag; C the *Aorta descendens* D the orifice of the *Aorta* into the bag; E E the axillary arteries; F that part of the bag, where it broke; 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, the bony *Lamina* in the inside of the bag.

Fig. 3. *a a a a* the *Sternum*; B its superior part; C its inferior part; D D its right side; E E its left side, in which the cartilages of the ribs G G were wanting; H H the place of the same bone worn off by the *Aneurisma*.

The Way of Colouring Marble. Phil. Trans. N° 268. p. 735. *Translated from the* Latin.

1. THE marble should be smooth, without any strain; the harder the better to bear the heat of the fire; and therefore alabaster is not fit for this purpose.

2. You must use fire to open its pores, yet in such a degree, as that it may not be ignited; for then the colours are burnt; nor in too little a degree; for tho' it receives the colours, yet they are less fixt; and even cold marble will imbibe some colours; as saffron stone blue for a sky-colour; but these are soon dissipated by the least degree of heat; therefore, let the degree of heat be such as suffices gently to boil the liquor poured upon the marble.

3. The *Menstrua* are various, according to the diversity of the ingredients to be dissolved; as a *Lixivium* made of horses urine, tho' dog's urine be better, and pot-ashes four parts, together with one part of quick-lime; also spirits of wine, the common *Lixivium*, wine, and some oleaginous substances.

4. The colours, that are laid on with vehicles, are the following. 1. Stone-blue dissolved either in spirits of wine, or a *Lixivium* of unslack'd lime. 2. Laque in the common *Lixivium*. 3. Saffron or sap-green dissolved with a *Lixivium* of urine and unslacked lime, or in spirits of wine. 4. Vermillion or cochineel dissolved as above. 5. *Sanguis Draconis* dissolved

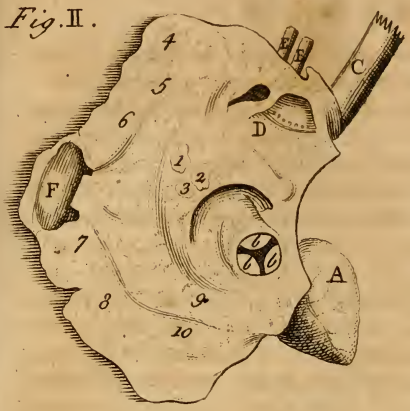
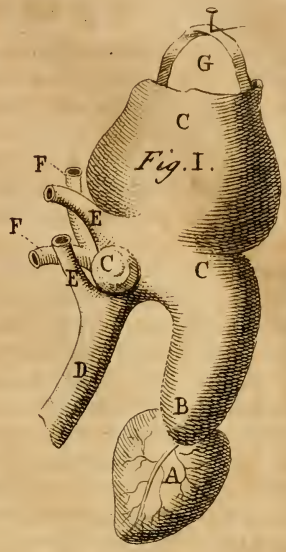


Fig. II.
4
5
6
C
D
F
1
3
2
7
A
8
9
10


G
C
Fig. I.
F
F
E
E
C
C
D
B
A

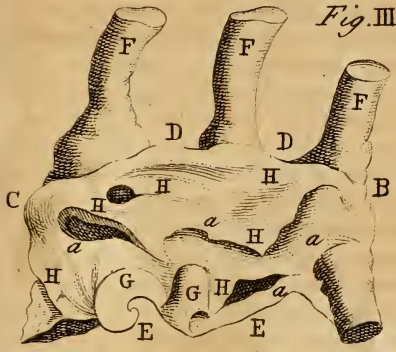


Fig. III.
F
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F
D
D
C
H
H
B
H
a
a
H
a
H
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H
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E
E

Fig. IV.
K
D
B
B
F
1
2
3
p. 505.
M
H
E
4
8
5
N
L
G
F
1
2
H
3
M
6
A
7
I
K
F

ved in ſpirits of wine; S. A. 6. Braſil wood diſſolved in ſpirits of wine. 7. An extract of *Alcanna* root, with oil of turpentine; for it cannot be diſſolv'd in any other *Menſtruum*; neither in ſpirits of wine, or a *Lixivium* of unſlacked lime as above; there is another kind of *Sanguis Draconis*, called *Lachryma*, which mixt with urine ſtrikes a pretty agreeable colour, but with difficulty; colours mixt with urine anſwer beſt.

5. Colours laid on without any vehicle, are, 1. *Sanguis Draconis* well cleaned for a red colour. 2. *Gum-gutta* for a yellow. 3. Green wax for a green. 4. Sulphur, pitch and turpentine, for a brown colour; and you need only give the marble a proper heat, and then rub on your colours, which experience will further teach you: Theſe colours are diſcharged with more or leſs difficulty; as a red colour in 24 hours with oil of tartar per *Deliquium*, without ſpoiling the poliſhing; a brown colour in a quarter of an hour with *Aqua fortis*, but the poliſhing is ſpoiled; for a golden colour, take flowers of ſal-armoniac, white vitriol and verdigreaſe, and grind them very fine.

An Account of the Bramines *in the* Indies; *by Mr.* John Marſhal. Phil. Tranſ. N° 268. p. 729.

UPON what grounds ſome travellers have ſtiled theſe people polytheiſts or atheiſts, Mr. *Marſhal* does not know; or whether there be any ſuch people in the world, except ſome of the baſer ſort in all nations, he much queſtions: It is very obſervable here, that when their prieſts or *Bramines*, and holy men, whom they call *Jogeés*, have occaſion to write any thing, they always put the figure of one in the firſt place, to ſhew, as they ſay, that they acknowledge but one God, who, they ſay, is *Burme*, that is, immaterial; when they preach to the people, and inſtruct them, which is commonly every feaſt-day, full moon, or the time of an eclipſe of either luminary, they talk much to them of God, heaven, and hell, but very imperfectly, obſcurely and myſtically; they ſay, that when God thought of making the world, he made it in a minute: They account this world the body of God; and that the higheſt heavens are his head, the fire his mouth, the air his breath and breaſt, the water his ſeed, and the earth and foundations thereof, his legs and feet; yet for all that they hold that God is immaterial; and aſſert in general, that he is the life of every thing, which yet is neither greater nor leſſer

for him; they hold that God dwelt in a vacuity, before he had created the world; and that as he dwelt in that vacuity, he created ſeveral beings out of himſelf; the firſt were angels, the ſecond ſouls, the third ſpirits, all differing in degrees of purity; the firſt being more pure than the ſecond, and the ſecond than the third; the angels they ſay neither act good nor evil; the ſouls either good or evil; but the ſpirits or *Dewta's*, as they call them, act ſcarcely any thing but evil; they have a good opinion of the angels, and reckon their ſtate mighty happy, hoping that when they die, they ſhall be made partakers of the ſame bliſs and pleaſure: They believe that every thing that hath life, has a ſoul, but eſpecially man; and they accordingly affirm, that as theſe ſouls behaved themſelves in their pre-exiſtent ſtate, ſo are their actions in this world either good or bad, by a ſort of fatal neceſſity, which is very hard to conquer, or overcome; hence it is, ſay they, that there are ſo many different humours and diſpoſitions of men; for their ſouls, before their entrance into their bodies, being tainted with different affections, cauſes the like differences in the parties, whoſe bodies are their vehicles; ſo that if a man happen to have a ſudden or unfortunate death, they immediately aſcribe the ſame to the perſons own wickedneſs, or the bad life that his ſoul led before it enter'd into his body; for, ſay they, the afore-acted evil that his ſoul did in its other life, brought theſe actions upon him, which, by being too powerful and ſtrong, get the upper-hand of him; and they believe, that ſuch as die thus, have their ſouls turn'd immediately into devils; they maintain *Pythagoras*'s tranſmigration, or *Metempſychoſis*, but in a groſſer ſenſe than he did; for they believe that men's ſouls, that have not lived ſo well as they ought, are tranſmigrated as ſoon as the body dies, not only into birds and beaſts, but even into the baſeſt reptiles, inſects and plants, where they ſuffer a ſtrong ſort of purgation, to expiate their former crimes; but as for the ſouls of the *Jogeés* or *Fuche*'s, that is, of religious men and ſaints, they fancy that they go and dwell with the good *Dewta's* or angels amongſt the ſtars: As for the ſpirits or inferior angels, they believe that they are very bad, and that they have a hand in all wickedneſs, murders, wars, ſtorms, and tempeſts; ſo that when they ſolemnize the funerals of the dead, they always preſent diſhes of meat, as offerings to thoſe ſpirits, and ſometimes they ſacrifice to them, that they may not hurt the ſouls of the dead: As they acknowledge the being of the mighty God, ſo they hold, that he created the

the world and every thing therein; they believe, that there is almoſt an infinite number of worlds, and that God has oftentimes annihilated and re-created the ſame; but how he came firſt to create this world and mankind, they relate to have been thus; once on a time, ſay they, as he was ſet in eternity, it came into his mind to make ſomething; and no ſooner had he thought the ſame, but immediately was preſented before him a very beautiful woman, which he called *Adea Sukteæ*, that is the firſt woman; then this figure brought into his mind that of a man, which he no ſooner conceived than he alſo ſtarted up, and preſented himſelf before him; this he called *Manapuiſe*, that is, the firſt man; then upon a reflection of theſe things, he reſolved further to create ſeveral places for them to abide in, and accordingly aſſuming a ſubtile body, he in a minute breathed the whole univerſe, and every thing therein, from the leaſt to the greateſt: They conſtantly believe that the univerſe cannot poſſibly laſt longer than 71 *Joogs*, which is a meaſure of time with them, and is . . . . years; which when it is come, God does not only annihilate the whole univerſe, but every thing elſe, as well angels, ſouls, and ſpirits, as inferior creatures; and then he remains in the ſame ſtate he was in, before the creation; but they ſay, that when he has thus reſpited a while, he breathes again, and every thing is created afreſh, as well angels, and ſouls, as other things; but as for the ſpirits, they are no more thought of; yet for all this, after 71 *Joogs* more, all is annihilated again: How many *Joogs* are paſt, ſince the world was laſt created, they cannot certainly tell; only it is obſervable, that in an almanac of theirs, written in the *Sanſcret* language in 1670, they make the world then to have been 3892771 years old from its laſt creation.

The *Bramines* of *Perſia* tell certain long ſtories of a great giant, that was led into a moſt delicate garden, which upon certain conditions, ſhould be his own for ever; but one evening, in a cool ſhade, one of the wicked *Dewta's*, or ſpirits came to him, and tempted him with vaſt ſums of gold, and all the moſt precious jewels that can be imagined; but he bravely withſtood that temptation, as not knowing what value or uſe they could be of to him; but at length this wicked *Dewta* brought to him a fair woman, who ſo charmed him, that for her ſake he very willingly broke all his conditions, and thereupon he was turned out: They tell a great many abſurd and ridiculous ſtories of the firſt ages of this preſent world; Mr. *Marſhal* gives

out of one of their own books, what they tell us, of a great flood that formerly happened; *viz.* that about 21000 years ago, the ſea overwhelmed and drowned the whole earth, excepting one great hill far to the northwards, called *Bindd*, and that there fled thither only one woman and ſeven men, whoſe names were, *Dehoolah*, *Sunnuk*, *Sunnaud*, *Trilleek*, *Sannotah*, *Cuppyloſhaw*, *Suraſchah*, and *Burroopung*; theſe, underſtanding by their books that ſuch a flood would come, and was then actually at hand, prepared againſt the ſame, and repaired thither; to which place alſo went two of all ſorts of creatures, herbs, trees, graſs, and of every thing that had life, in all to the number of 1,800,000 living ſouls; this flood, they ſay, laſted 120 years, 5 months, and 5 days; after which time all thoſe creatures, that were thus preſerved, came down again, and repleniſhed the earth; but as for the ſeven men, only one of them came down with the woman, and dwelt at the foot of the mountain; the other ſix turned *Fucees*, or holy men, and there they ſpent the remainder of their days.

They hold in general the *Ptolemaic* ſyſtem of the univerſe, and ſay that there are 8 or 9 heavens, reckoning the air and earth; every one exceeding the other in beauty and glory.

Their religion conſiſts of nothing, as far as Mr. *Marſhal* could ever ſee or learn, but leading of a pure life, the waſhing their ſins away in the river *Ganges*, their muttering over divers prayers, and their doing ſtrange and incredible penances: They ſay, that God is ſuch a one, that whoſoever ſeeks him, let it be after what manner he pleaſes, whether by thinking that he is the ſun, the moon, or the like, if they do it but ſincerely and honeſtly, with a well diſpoſed heart, they will be accepted of him; they report, that, on a certain time, a *Muſſulman* ſeeing a *Hindoo* or pagan prieſt in heaven, he asked God, how that infidel, whom *Mahomet* ſo often calls by the name of *bitter Roots*, came to have admittance thither; to whom God anſwered, that if a bitter root bring forth ſweeter fruit than any of you, why ſhould not I receive it? upon which the *Muſſulman* had no more to ſay; they hold, that ſuch, as do not ſuffer their minds to wander after the luſts of the world, are perfect *Jogees* or ſaints, and that God is always preſent with them in all their actions: It is to be found in ſeveral of their books, that there was a time, a good while ago, in which God took upon him the ſhape of a man, and ſpent many years in reforming the world, and giving better rules to walk by, than there had been before; but he having at length left them, they ſoon forgot him and his rules, and returned to their former courſes; upon

upon which he told them, that he would leave them to their ways, and never undertake any such thing again.

The religious, at some certain seasons of the year come to the river *Ganges* (which they call the holy river) in vast multitudes, even from many parts of *Tartary*, to wash away their sins, and make expiation for their faults; this *Ganges* is a delicate fine river, chiefly on account of its very sweet, pure, and clear water, which has got it the greatest esteem of any river in the east; Mr. *Marshal* sailed several times up this river, and found it in some places not above a mile broad, in others not half so much, and in one or two places not above an eighth of a mile; in *April*, when the water is at the lowest, it is almost dry in several places; but when it is at the highest, which is commonly about the middle of *September*, it is very deep, and several miles broad: When the people are gathered together here, they have a great many strange customs, and ceremonies, and pay a kind of divine honour and worship to the river, too long to mention; the *Hindoos* and *Bramines* preach then every day to the people, teaching them their duty, and ordering them to say such and such prayers; but above all things to be charitable to the poor and needy.

It is reported, that on the hills of *Casmere* there are men that live some hundred of years, and can hold their breath, and lie in trances for several years together, if they be but kept warm; and that every year some of them come down to the people at the *Ganges*, and perform several cures; for whom they have such a veneration, that they frequently drink the water they wash their sweaty feet in: The penances and austerities that they undergo are almost incredible; most of them, thro' their continual fastings, and lying upon the parching hot sand in the heat of the sun, are so lean, dried and withered, that they look like skeletons or shadows, and one can scarce perceive them breathe, or feel their pulse beat; when any great man dies amongst them, but especially any of their *Jogees*, or saints, they make great preparations for his funeral; the corpse is laid on its belly, and salt and rice set round about it, at every corner on the ground; then the nearest relations to the party deceased carry a pot of water on their shoulders several times about the funeral-pile; then breaking the pot in pieces, they spill the water; which ceremony being ended, they set fire to the pile, and then all the relations begin to howl, and embrace one another; then washing themselves in some neighbouring river, they depart every one to his home; and as to the remaining ashes, if he is rich, they gather them

them up, and caſt them into the *Ganges*, or the ſea: Sometimes it happens that the wife of the deceaſed party, if ſhe has no children, and is old, and poor, will burn herſelf with the dead body; but this happens very ſeldom: It is ſaid that in ſuch caſes, the *Bramines* give the woman a ſtupifying liquor, which, by the time that they are in the fire, makes them inſenſible of any pain: To know into what body, the ſoul of the deceaſed is tranſmigrated, they do thus; they ſtrew the aſhes of the dead upon the place, where he was firſt laid after his death, and handfuls of odoriferous flowers about the ſame; and returning again in 44 hours, they judge by ſome pretended impreſſion or other in the aſhes, into what body it is gone; if the foot of an horſe, dog, or ox, or ſuch like appears, then they give out, that it is certainly gone into ſuch creatures; but if nothing appear, then they think it is certainly gone to the ſtarry regions: As for their learning and knowledge, it is but little; they have indeed ſeveral books written in divers languages; but they contain nothing, but a great deal of ſtuff and cant about their worſhip, rites and ceremonies: They are ignorant of all parts of the world but their own; they wonder much at us, that take ſo much care, and pains, and run thro' ſo many dangers both by ſea and land, only, as they ſay, to ſupport and nouriſh pride, and luxury; for, they ſay, every country in the world is ſufficiently endowed by nature with every thing that is neceſſary for the life of man, and that therefore it is madneſs to ſeek for, or deſire that which is needleſs and unneceſſary.

The laſt time Mr. *Marſhal* was at *Modufferpore* in *Indoſtan*, he had a great deal of talk with a *Bramine*, ſomewhat more learned than any of the reſt, his name was *Ramnaunt*; he told Mr. *Marſhal* ſeveral ſecrets in phyſic, as alſo ſeveral traditions and ſtories; he ſaid, that if you bury a piece of money for ſome conſiderable time in the mouth of a live frog, and then dig it up again at midnight, that this piece of money, to whomſoever you give or pay it, will always return to you again; he further ſaid, that if the little worm in the wood *Lukerakera* be cut in two, and that the one part ſtirrs, and the other not, if the ſtirring part be bruiſed, and given with half a beetle to a man, the other half to a woman, this charm will keep them from ever lying abſent one from the other: They have books full of the like abſurdities, together with cabaliſtic complications of figures; as for example, if you write theſe following numbers, 28, 35, 2, 7 — 6, 3, 32, 31 — 34, 29, 8, 1 — 4, 5, 30, 33 — in the ſquares of a ſquare figure, and your enemy's name under it, and wear it always about you,

you, he shall never be able to hurt you; so if you write the following figures in like manner upon the left-hand, 2, 9, 2, 7. — 6, 3, 6, 5. — 8, 3, 8, 1. — 4, 5, 4, 7 — with turmeric, and wash it off with fair water of the *Ganges*, and drink it, this will cure all venomous bitings; they have many such ridiculous fancies, all which they seem to have borrowed from the *Cabala* of the *Saracens*, which is full of such like fooleries: Mr. *Marshal* heard a *Bramine* say, that if some of the pieces or knots of the cloth (in which a woman has been burnt with her husband) be saved and made up in the form of a wick, and fitted for a lamp, and lighted, and set in a dead woman's scull, that it would make the dead party appear; this the *Bramine* said he had done; when they have any mad persons amongst them, they take them, and put them into a close room, just big enough to hold them, and smoke them almost to death, with musk and other cold smells, which soon restores them to their right mind, and so recovers them, *&c.*

There happened two things in our voyage, which was very observable; the first was, that all the tornadoes brought a deal of rain with a stench; and if the seamen did but lay their cloaths by for 24 hours, they became all full of little maggots; the second was, when we came out of *Europe*, we took in some water at St. *Jago*'s; and when we were almost at our journey's end, our cooper going with a candle to open one of the casks, he had no sooner done it, than the water immediately took fire, and burnt his face, hands and fingers; but turning suddenly about, he quenched it, by setting his breech thereon; the water also stunk pretty much at the same time, but afterwards it came to its native sweetness, *&c.*

A triple Bladder; *by M.* Bussiere. Phil. Transf. N° 268. p. 752.

IF the bodies of such as die of extraordinary distempers were often opened, perhaps it would be found, that those effects, which had been attributed to the alteration of the blood, or humours, do merely depend on an extraordinary conformation of the parts of the body; an instance of which, there was a triple bladder found in the body of one Mr. *Booth*; we have been told of a double bladder found in the bodies of some men (as there was in the body of the famous *Casaubon*) but M. *Bussiere* never met with any author, that mentions three urinary bladders found in one person.

This

This gentleman in his beſt health could not make urine in a full and continued ſtream, it running out by little and little, and with great efforts of inſpiration; eſpecially when there was but a ſmall quantity in the bladder, which fatigued him very much, tho' the paſſing of the urine thro' the neck of the bladder was not painful; excepting the two or three laſt years of his life, by reaſon of a thick *Mucus*, which was then diſcharged with the urine, that *Mucus* growing in greater quantity, made him apprehenſive it had been cauſed by a ſtone in his bladder; upon which he applied himſelf to one, in order to be ſearched, who accordingly introducing his catheter, and meeting with ſome reſiſtance in the *Urethra*, he forced his catheter thro' the membranes, wherein he made ſuch a dilaceration, that the patient immediately loſt a great quantity of blood; which bleeding continuing for ten days, without his ſeeking any help, brought him under very great torments, by reaſon the blood was become grumous in the *Urethra*, and could not be forced out, but by very violent efforts, and acute pain, which cauſed a mortification in the part, whereof he died.

The next day after his death M. *Buſſiere* opened the body, in preſence of Drs. *Dawes*, *Chamberlain*, *Woodward*, Mr. *Bernard* the ſurgeon, and ſeveral others, in which the natural urinary bladder was found lying on the left ſide of the *Pelvis* upon the *Ilium*; then ſearching what ſhould be the cauſe of this unnatural ſituation, he found one large round bag, lying under the *Pubis* upon the *Rectum*, taking up all the cavity of the *Hypogaſtrium*; in order to examine the matter more exactly, he diſſected the *Penis* and the *Rectum*, and taking them out of the body, he put them upon a table, laying open the *Urethra*, to examine whether there was any carnoſity, as the ſurgeon, who firſt introduced the catheter, had ſuſpected, but there was none; and that *Ductus* was as plain, and ſound as could be, except the dilaceration the catheter had made therein; then introducing a conductor into the bladder, he divided it quite; and firſt it was obſerved, that the round bag, which conſiſted of two bladders, or rather two *Ciſtes*, were divided from each other only by a membrane; that which was next the true bladder was ſomething bigger than it, the other which lay on the right ſide was much ſmaller; each of theſe *Ciſtes* had its orifice opening in the neck of the natural bladder which was longer than it uſually is; neither of the *Ureters* were inſerted into any of theſe *Ciſtes*, but into the neck of the true bladder, by the orifices of the two *Ciſtes*, inſomuch that the urine could be equally received by them and the bladder; ſecondly,

ſondly, it was obſerved, that the glands of the true bladder were exceeding big and red, that colour being very likely, the effect of the inflammation, cauſed by the dilaceration of the *Urethra:* M. *Buſſiere* oftentimes obſerved, that a thick *Mucus*, which runs out of the bladder, and which ſome take to be the matter of an impoſthume, or ulcer in the kidneys, is only produced by thoſe glands of the bladder becoming ſcrophulous; and that when that *Mucus* grows thick and clammy, it cauſes the ſame pain on the neck of the bladder, as if it were a ſtone; the glands of the large *Ciſtis* were very apparent, but very ſmall; but were not at all ſenſible in the ſmaller *Ciſtis*.

Now it is eaſy, by the deſcription of theſe bladders, to account for the ſymptoms; for by the ſituation of the large *Ciſtis*, it is plain, that the urine could not be diſcharged, but by the force of inſpiration; its own muſcles not being able to force it out, and conſequently it could not be voided but by little and little; and theſe efforts of inſpiration were to be the greater, when there was but a little quantity of urine, becauſe it required a greater force to make it aſcend from the bottom of the *Ciſtis*, which could not be done without great labour and fatigue.

Plate XIV. Fig. 4. AA repreſents the body of the true bladder; 1, 2, 3, 4, 5, 6, 7, 8, its glands; BB the larger *Ciſtis*; CC the ſmaller *Ciſtis*; 1, 2, 3, its *Rugæ* or wringles; D part of the true bladder turned over; E the neck of the bladder; FFFF, the two *Urethræ*; G the inſertion of the ſpermatic veſſels into the *Urethra*; HH the *Proſtatæ*; II the *Veſiculæ Seminales*; KK the *Vaſa deferentia*; L the *Urethra*; MM the *Muſculi Erectores*; N, the *Penis*.

The Foſſils *of* Reculver *Cliffs*; *by Mr.* S. Gray; *with a Remark by Dr.* Sloane; Phil. Tranſ. N° 268. p. 762.

ABOUT half a mile from *Reculver* towards *Herm*, there appear in the cliff, *Strata* of ſhells of the white *Conchites* ſort, lying in a greeniſh ſand; they ſeem to be firm, and ſome of them are entire, but when you go to take them out of their beds they crumble to powder between your fingers; but what is moſt remarkable is, that in the lower part of the *Strata*, where the ſhells lie thickeſt, there are ſcattered up and down, portions of trunks, roots, and branches of trees; the wood was become as black as coals, and ſo rotten, that large pieces of it might be broken with one's fingers; Mr. *Gray* did not know at what depth theſe might lie, the ſurface of the *Strata* appearing not above two foot from the beach; but he judged it, from the ſuperficies of the top of the

of the ſun and ſtar; then by bringing the two oppoſite points in the fixed circle to the perpendicular, which is done at the time of fixing the inſtrument, move the circle till the day of the month come to any of theſe, and the ring is rectified for that day; and if the air be clear, you will ſee the ſtar ſtand at the true time of the day or night.

It may be objected, that in a few years, by the annual increaſe of its declination, the pole-ſtar will, by moving in a leſſer circle, be brought too far from the edge of the ring, that the exact hour and minute cannot well be diſtinguiſhed; but this inconveniency, when it is one, may be eaſily remedied ſeveral ways; either by making a leſſer ring, or by extending a fine thread of ſilk croſs the ring, till it cuts the ſtar, and at the ſame time it gives the hour; or, which will yet make this inſtrument commodious for other purpoſes, there may be made an index to move on the center of the hour wheel, which being brought to cut the ſtar with the edge that proceeds from the center, it will at the ſame time cut the hour; and now we need not be ſollicitous about the exact diameter of the ring, provided it do but a little exceed the diſtance of the pole-ſtar from the pole, the focal length of the glaſs being made the radius.

Mr. *Flamſtead* has diſcovered, that there is a parallax of the earth's annual orbit at the pole ſtar; of about 40 or 45 ſeconds; whereby the diameter of the ſtar's parallel is greater in *June* than in *December*, by about 1 min. 2 ſeconds; which he has evinced from ſeven years ſucceſſive obſervations, whereby the earth's motion is undoubtedly demonſtrated: Now if upon the edge of this index there be drawn a ſcale of degrees, minutes, and ſeconds, to the radius of the glaſs, we ſhall have not only a very accurate inſtrument for the hour, but be furniſhed with one, whereby we may ſee the truth of the earth's motion confirmed, by the acceſs and receſs of our ſtar towards and from the pole, according to the earth's place in the ecliptic, as Mr. *Flamſtead* has diſcovered; and that not only when the ſtar tranſits the meredian, but in a clear air at any time of the day; one ſhall likewiſe obſerve that annual increaſe of the declination of the pole-ſtar, cauſed by the preceſſion of the *Equinox*.

Mr. *Gray*'s obſervations aſſured him, that the pole-ſtar may be ſeen in the day time with a teleſcope of 16 foot; for with one of that length he ſaw it on the 26th of *April* 1701 from 4 o'clock in the morning 'till 7, and could have ſeen it longer, had not clouds interpoſed; and again the 1ſt of *May*, tho' he did not look for the ſtar, untill the ſun had been up more than half

half an hour, *viz.* at 5 in the morning; yet he ſoon found it, and ſaw it afterwards, as often as he pleaſed, untill half an hour after 9 the ſame morning; ſo that he doubts not, but that this ſtar may be ſeen in a clear day throughout the whole year: The declination of the polar ſtar for the year 1700 is 87°. 42′. 51″, as he finds it by *Ricciolus*'s catalogue of fixed ſtars, in the appendix to Sir *Edward Sherbourn*'s ſphere of *Manilius*, &c. hence its diſtance from the pole at this time may be aſſumed 2°. 17′; the focal length of his object-glaſs was 15 foot 6 inches; ſo that the diameter of the ring will be 14 inches and 84 hundredth parts of an inch, which is the natural tangent of the former arch 2°. 17′ doubled; a circle large enough to be divided into minutes and halves, which will be ſo magnified by the eye-glaſs, that it will be eaſy to diſtinguiſh the time to a few ſeconds; it is true, there is ſome difficulty in fixing up this inſtrument; and when it is ſo, to keep it from varying from its due poſition; but yet it is not inſuperable; but for ſmall inſtruments, of about two or three foot long, there cannot be a more accurate, eaſy and expeditious way, than this for drawing a meridian line.

An Argument between Dr. Wallis *and Dr.* Tyſon, *concerning* Men's *feeding on* Fleſh. Phil. Tranſ. N° 269. p. 769.

GASSENDUS in one of his epiſtles eſpouſes it as his opinion, that it is not originally natural for man to feed upon fleſh; tho' by long uſage, at leaſt ever ſince the flood, we have been accuſtomed to it, and it is now become familiar to us; but rather, on plants, roots, fruits, grain, &c. and Dr. *Wallis* takes it to be the opinion of ſeveral Divines, that before the flood, men did not uſe to feed on fleſh, becauſe of what God ſays to *Noah Gen.* ix. 3. after the flood, *Every moving thing that liveth ſhall be meat for you, even as the green herb have I given you all things*; compared with *Gen.* i. 29. where God ſays to *Adam, I have given you every herb bearing ſeed, and every tree, in which is the fruit of a tree yielding ſeed, to you it ſhall be for meat*; but without any intimation of his feeding on the fleſh of animals; yet the Dr. had ſome doubt remaining; ſeeing we find very early, that *Abel* was a keeper of ſheep, as well as *Cain* a tiller of the ground, both imployments ſeeming to be equally in order to their food and ſuſtenance; and their firſt cloathings were the ſkins of animals: It may perhaps be thought, theſe animals were ſlain for ſacrifice, and the ſheep fed only for that purpoſe; but even their ſacrifices ſeem to have been offered only as a portion, or firſt fruits, of things appointed for food; and that

as

as *Cain* was not to ſacrifice the whole fruits of his tillage, ſo, neither was *Abel*, the whole product of his ſheep, but the beſt, that is the firſtlings of his flocks, and the fat thereof, reſerving the reſt for his own uſe; and it is not probable, that God would grant *Noah* after the flood, a greater dominion over other animals, than had been given to *Adam*, in paradiſe before the fall; and the Dr. then takes this permiſſion to *Noah*, not as contra-diſtinct from that to *Adam*, but rather as introductive of the prohibition, which preſently follows, to wit, tho' he might eat fleſh, even as the green herb (ſo far as it might be wholeſome food) yet, not with the blood thereof; that is not raw fleſh; the Dr. adds alſo, that the ſame rule is given to other animals *Gen.* i. 30. as is to man at ver. 29. *I have given them every green herb for meat*; yet there are, we know, ſeveral carnivorous animals, without any further permiſſion that we know of: But without diſputing it as a point in divinity, the Dr. conſiders it with *Gaſſendus*, as a queſtion in natural philoſophy, whether it be proper food for men: The conſideration inſiſted upon by *Gaſſendus*, is from the ſtructure of the teeth, being moſtly either *Inciſores*, or *Molares*, not ſuch as, in carnivorous animals, are proper to tear fleſh, excepting only four, which are called *Canini*, as if nature had rather furniſhed our teeth for cutting herbs, roots, *&c.* and for bruiſing grain, nuts, and other hard fruits, than for tearing fleſh, as carnivorous animals do, with their claws, and ſharp teeth; and even, when we feed on fleſh, it is not without a preparative concoction, by boiling, roaſting, baking, *&c.* and even ſo, we forbid it to perſons in a fever, or other like diſtempers, as of too hard digeſtion; and children, before their palates are vitiated by cuſtom, are more fond of fruits, than of fleſh-meat; and their breeding worms is wont to be imputed to their too early feeding on fleſh: This ingenious conjecture of *Gaſſendus*, did preſently ſuggeſt to the Dr. another ſpeculation, which ſeems no leſs conſiderable; *viz.* there is in ſwine, ſheep, oxen, and he thinks, in moſt quadrupeds, that feed on herbs or plants, a long *Colon* with a *Cæcum* at the upper end of it, or ſomewhat equivalent, which conveys the food by a long and large progreſs from the ſtomach downwards, in order to a ſlower paſſage, and longer ſtay in the inteſtines; but in dogs of ſeveral kinds, and he ſuppoſes, in foxes, wolves, and divers other animals, which are carnivorous, ſuch *Colon* is wanting; and inſtead thereof, is a more ſhort and ſlender gut, and a quicker paſſage thro the inteſ-

tines;

tines; what the Dr. would propoſe hereupon, is, whether it generally holds, or how far; that animals, which are not carnivorous, have ſuch a *Colon*, or ſomewhat equivalent; and that thoſe which are carnivorous have it not; for if ſo, it ſeems to be a great indication, that nature, which may be reaſonably preſumed to adapt the inteſtines to the different ſorts of aliments that are to paſs thro' them, accordingly informs us, to what animals fleſh is proper aliment, and to what it is not; and that from thence we may judge more ſolidly, than from the ſtructure of the teeth only, whether or not fleſh was deſign'd as proper food for man? Now it is well known that in man, and poſſibly, in the ape, monkey, baboon, *&c.* ſuch *Colon* is very remarkable; it is true, that the *Cæcum* in man is very ſmall, and ſeems to be of little or no uſe; but in a *Fœtus*, it is in proportion much larger than in adults, and it is poſſible; that our cuſtomary change of diet, as we grow up, from what originally would be more natural, may occaſion its ſhrinking into this contracted poſture; but the Dr. adds alſo, that man's being endow'd with reaſon, ſupplies the want of ſeveral things, which to other animals may be needful; man is not covered with ſuch quantity of hair or feathers all over his body, which to other animals ſerve for cloathing; but he can, by the uſe of his reaſon, ſupply himſelf with cloaths ſuitable to every climate, and to the different ſeaſons; he is not furniſhed with claws, hoofs, horns, *&c.* which ſerve for arms to other animals, but he can by the uſe of his reaſon ſupply himſelf with weapons, and other inſtruments for different occaſions, to much better advantage; and in the preſent caſe, tho' raw fleſh be not proper, as it is to ſome other animals, he can by preparative coctions, and other expedients, render it more agreeable; nor is he wholly deſtitute of *Dentes Canini*; but is indeed furniſhed with all ſorts of teeth, for all ſorts of wholeſome food: The Dr. takes the ſheep, the goat, the ſwine, the ox, the horſe, the aſs, the camel, the elephant, the hart, the hare, the rabbit, the mouſe, *&c.* not to be carnivorous; but the dog, the wolf, the fox, the cat, the lion, the leopard, the tyger, *&c.* to be naturally carnivorous; which of all theſe have, or have not the *Colon*, or what other diſtinguiſhing mark may be obſerved between theſe different tribe of animals, the Dr. thinks may deſerve a ſerious conſideration.

The argument Dr. *Wallis* propoſes from the conformation of the inteſtines, why man ſhould not be carnivorous, ſeems far more

more rational to Dr. *Tyſon*, than that which *Gaſſendus* urges, from the ſtructure of the teeth; tho' it muſt be owned, he hath omitted nothing, that could have been ſaid to favour it: But before Dr. *Tyſon* would more particularly conſider Dr. *Wallis*'s *Hypotheſis*, he remarks that had man been deſigned by nature not to have been a carnivorous animal, no doubt there would have been obſerved, in ſome part of the world, men which did not at all feed upon fleſh; but ſince no hiſtory (as Dr. *Tyſon* knows) furniſhes us with ſuch an inſtance, he cannot but think, that what hath been done univerſally by the whole ſpecies, muſt be natural to them: What the *Pythagoreans* did, in abſtaining from fleſh, was upon the notion of a *Metempſychoſis*, or tranſmigration of ſouls, a miſtake in their philoſophy, and not a law of nature; and tho' in ſome countries men feed more freely on fleſh, in others more ſparingly, this is owing to their own choice, from the advantage they find thereby; nature having given mankind reaſon, they can, or ought to chuſe what food they find moſt agreeable in the climate wherein they live; and are not determined to any one ſort, but have liberty to uſe all; and it is as probable, the antediluvian world had ſo likewiſe; wherefore Dr. *Tyſon*, wholly acquieſces with Dr. *Wallis*'s determination of this point.

To conſider it as a queſtion in natural philoſophy; whether from the obſervation of the ſtructure of the parts in man, we can find reaſon to think nature did, or did not deſign him to be carnivorous; Dr. *Tyſon* is of *Gaſſendus*'s opinion, *viz.* that from the conformation of the parts of the human body, we may form conjectures concerning their mere natural functions; for all the knowledge we have of the uſes of the parts in animal bodies, is by obſerving nature's wonderful contrivance in their formation, which moſt wiſely adapts them to the uſes they are deſign'd for; not becauſe they are caſually ſo and ſo formed, they are neceſſarily put to ſuch and ſuch uſes; but therefore they are ſo contrived, that they may perform ſuch offices in the animal oeconomy as nature intends them for; and Dr. *Tyſon* gives ſeveral remarkable inſtances, in his treatiſe of *Homo Sylveſtris*, that ſufficiently confute ſuch unphiloſophical atheiſts.

Dr. *Tyſon* takes Dr. *Wallis*'s obſervation, from the different formation of the inteſtines in carnivorous animals, from thoſe that are to be found in ſuch as do not feed upon fleſh, to be of far greater weight, and to carry more ſtrength in it, than any thing he ever met with before; he therefore, firſt of all obſerves, that the *Ductus alimentalis*, for ſo he calls the *Gula*, ſtomach

ſtomach, and inteſtines, being all but one continued canal) this *Ductus*, he ſays, is properly the characteriſtic of an animal, or *Proprium quarto modo*; there being no animal without ſuch a duct: Plants receive their nouriſhment by numerous fibres from their roots, but have no common receptacle for digeſting the food received, or vent for carrying off the recrements; but in all, even the loweſt degree of animal life, we may obſerve a ſtomach and inteſtines, where we cannot perceive the leaſt formation of any organ of the ſenſes, unleſs that common one of touch, as in an oiſter; where alſo we may obſerve a ſenſible muſcular motion, or contraction; tho' it would be difficult to aſſign what part ſhould be reckon'd the brain, or ſpinal marrow, from whence the nerves ariſe that give it ſo ſtrong a motion: Now this duct being ſo principal a part in an animal, and its uſe being to receive and digeſt the food, and diſtribute the chyle, 'tis reaſonable to ſuppoſe, that according to the difference of the food, the ſtructure of the organ ſhould alſo be different, or where the organ was the ſame, there the uſe was alſo the ſame: Man therefore having theſe parts formed, not like carnivorous animals, but more reſembling thoſe that live on herbs, roots, fruits, *&c.* it may ſeem reaſonable to conclude, that nature never deſign'd him to live upon fleſh; but that the wantonneſs of his appetite, and a depraved cuſtom, had inured him to it, as *Gaſſendus* remarks in one of his epiſtles; *viz.* that cuſtom may make that ſeem natural to us, which nature never intended, as he inſtances in a lamb bred on ſhip-board, which refuſed the green paſture of the fields, for the diet it was formerly uſed to; and the Dr. has often ſeen in *London* a horſe, that with a great deal of pleaſure, would eat oyſters, ſcranching them ſhell and all between his teeth and ſwallowing them down; and this the Dr. takes to be by accident, being left at a tavern-door, where ſtood a tub of oiſters, and after that the horſe did the ſame frequently, whenever they were offered him; now *Gaſſendus* obſerves, that children (from whom he thinks we may better take the inſtincts of nature, than from our appetites when depraved by cuſtom) are much fonder of fruit, than of any fleſh that is offered them; and therefore he ſuppoſes it more natural to them.

The inſtance Dr. *Wallis* gives, wherein the ſtructure of the inteſtines of carnivorous animals is different from that in men, is; that the former want a *Colon*; whereas in men there is a very large one, which is not to be obſerved, but in ſuch ani-

mals as live upon fruits, roots, herbs, &c. the queſtion is, whether it does generally hold, or how far, that animals that are not carnivorous have ſuch a *Colon*, or ſomewhat equivalent, and thoſe that are carnivorous have it not?

To begin with thoſe animals that are carnivorous, and have no *Colon* or large *Cæcum*, tho' theſe may have the *Appendicula Vermi-formis*, yet if that is not extended, or filled with the *Fæces*, which the other guts contain, Dr. *Tyſon* does not think it ſhould properly be eſteemed, as a diſtinct gut, or be reckon'd in that number, ſince here it does not perform the office of one, in containing the food, or excrement; ſo in a man; in dogs, and other animals, when it is thus contracted, Dr. *Tyſon* excludes it out of the number of the inteſtines, tho' by uſe and cuſtom, (for which he ſees no reaſon) it is commonly reckon'd one of the *Inteſtina craſſa*: Amongſt animals therefore that have no *Colon*, or large *Cæcum*, tho' ſome of them have this *Appendicula Vermi-formis*, and are carnivorous, he reckons. 1. The dog-kind; under which, beſides their own ſpecies, may be included the fox, the wolf, the *Coati mundi*, the badger, the otter, &c. 2. The vermin-kind, as the weeſel, the fitchet, the pole-cat, the martin, &c. both theſe kinds have a bone in the *Penis*, and no *Colon* or *Cæcum*; ſome have the *Appendicula Vermi-formis*, and all are carnivorous. 3. The cat-kind, beſides their own ſpecies including, the lyon, the tyger, &c. it is true the *French* Memoirs tell us, that a lyon had a *Colon* 18 inches long, and an *Appendicula Vermi-formis* three inches; yet Dr. *Tyſon* queſtions whether this may be properly called a *Colon*; for tho' the gut about this place may be more extended than in others, yet it has not thoſe ligaments, whereby the gut is corrugated into cells, as in a human body; ſo likewiſe, as to the *Colon* in a cat. 4. A boar hath no *Colon* or *Cæcum*. 5. Nor has a mole any. In the next place Dr. *Tyſon* comes to conſider thoſe animals that are not carnivorous, which have a *Colon* or *Cæcum*, or both; for as to Dr. *Wallis*'s query, he thinks it much the ſame, whether they have either one of theſe only, or both; provided, that the capacity of the gut there be large and contain *Fæces*; as 1. The horſe-kinds. 2. The elephant. 3. The dromedary and camel. 4. The ſeveral ſpecies of the ſwine-kind. 5. The *Guiney* pig. 6. The Beaver. 7. The hare-kind. 8. The ape and monkey-kinds. Now there are ſeveral animals not carnivorous that have a large *Cæcum* and no *Colon*; as, 1. The neat-kinds. 2 The ſheep-kinds. 3. The ſtag-kinds. 4. The goat-kind. 5. The antelope. 6. The ſquirrel-kind. 7. The rat-kind. But not-

with-

withſtanding all this, Dr. *Tyſon* thinks we may as well argue, that becauſe the neat-kind, the ſtag-kind, &c. that live on herbage, have four ſtomachs, therefore thoſe that have not four, were not deſigned by nature to be graminivorous; now the horſe-kind, &c. has but one ſtomach, and yet their food is graſs; and the caſe is here the more remarkable, becauſe the ſtomach is a part more principally concerned in digeſting the food; yet we obſerve, even in animals, that live upon the ſame ſort of food, that their ſtomachs are very different; one would therefore be more apt to think, that for digeſting the variety of food, the organ, which is to perform it, ſhould be different too; yet we find the ſtomachs of animals, that live upon different food are very much alike; if therefore, we cannot draw a concluſion from the ſtructure of the ſtomach, what food is moſt natural to an animal, much leſs, can we from the *Colon*, or the *Cæcum*, being parts of the alimentary duct, that are remote from the ſtomach; which ſeem to be only a common ſhore, for the reception of the *Fæces:* Nature obſerves great variety, in the formation of the ſtructure of this alimentary duct in different animals; and even where we may obſerve much the ſame ſort of food, yet we do not always find the ſame ſtructure, tho' her intendment be the ſame in all, *viz.* to digeſt the food, diſtribute the chyle, and eject the *Fæces:* Since man therefore hath all manner of teeth, fit for the preparation of all ſorts of food, before it be conveyed to the ſtomach, and this laſt organ is alſo adapted to digeſt all ſorts of food; Dr. *Tyſon* rather thinks, that nature intended he ſhould live upon all; or at leaſt not deny him any, or ſtint him to one ſort only; as in the text already quoted, *Gen.* ix. v. 3. To give ſome inſtances in brutes, where it does not hold, that all carnivorous animals have no *Colon* or *Cæcum*, the *Opoſſum* has a long *Colon*, tho' not cellulated, and a large *Cæcum*, that receives all the fæces, as they paſs downwards; yet this animal feeds upon poultry, birds and other fleſh; on the other hand the hedge-hog, that hath no *Colon* or *Cæcum*, and therefore by Dr. *Wallis*'s rule, ſhould be carnivorous, feeds only on roots; hogs likewiſe, that have both a *Colon* and *Cæcum*, will feed greedily upon fleſh, tho' their ordinary food be of another kind; as alſo a rat and mouſe, that have a large *Cæcum*, but no *Colon*, feed upon bacon, as well as bread and cheeſe; therefore Dr. *Wallis*'s obſervation as to brutes, tho' it may hold for the moſt part true, yet it is not univerſal.

Dr. *Wallis* agrees in theſe ſentiments, and is inclined to think, that all nations, both before and after the flood, have uſed to feed on fleſh duly prepared; tho' on the other hand he thinks, that raw

flesh (as it is the common food of carnivorous animals, is not a natural food for us; and he does not know that any nation has of choice used to feed on raw flesh, unless in cases of extremity, &c. If there be any such, he looks upon it as an anamolous case, as also the rat's eating bacon (which yet is not quite void of coction) for want of other food; and as to swines sometimes eating poultry, Dr. *Wallis* does not take it to be purely natural, but rather the effect of an appetite depraved by custom; because much of the hog-wash, which is given swine, comes from the coction of flesh for our own use; and this inures them to the taste of it.

Dr. *Wallis* leaves it to be considered from what reason, for what use, and in what degree the passage of flesh thro' the alimentary duct, should ordinarily be more quick, and that of herbs more slow, and in what degree it is so; and again, whereas nature seems to have originally designed a large *Cæcum* in man, as in some other animals; how it comes to pass, that in adults it is of little or no use, but shrinks up into an *Appendicula Vermi-formis*; whether or not this may not partly proceed from our feeding so much upon flesh.

The END of the THIRD VOLUME.

THE

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CORRIGENDA.

PAGE 174. *l.* 10. *r.* Battle of Flowden-field. *P.* 284. last line save four for Hindostan *r.* Indostan. *P.* 323 Line penult. for hicher *r.* thicker. last Line save 8 for successively *r.* successfully.

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